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SIXTY-SECOND

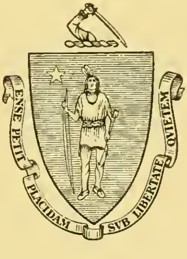
ANNUAL REPORT OF THE SECRETARY

OF THE

MASSACHUSETTS

STATE BOARD OF AGRICULTURE.

1914.



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STATE BOARD OF AGRICULTURE, 1915.

Members ex Officio.

HIS EXCELLENCY DAVID I. WALSH.
HIS HONOR GRAFTON D. CUSHING.
HON. ALBERT P. LANGTRY, *Secretary of the Commonwealth.*
KENYON L. BUTTERFIELD, *President, Massachusetts Agricultural College.*
LESTER H. HOWARD, *Acting Commissioner of Animal Industry.*
F. WILLIAM RANE, *State Forester.*
WILFRID WHEELER, *Secretary of the Board.*

Members appointed by the Governor and Council.

	Term expires
HENRY M. HOWARD of Newton (P. O. West Newton),	1915
CHARLES M. GARDNER of Westfield,	1916
FRANK P. NEWKIRK of Easthampton,	1917

Members chosen by the Incorporated Societies.

Amesbury and Salisbury (Agricultural and Horticultural),	A. WILLIS BARTLETT of Salisbury,	1918
Barnstable County,	JOHN BURSLEY of Barnstable (P. O. West Barnstable),	1916
Blackstone Valley,	JACOB A. WILLIAMS of Northbridge,	1918
Deerfield Valley,	DAVID T. BARNARD of Shelburne,	1917
Eastern Hampden,	O. E. BRADWAY of Monson,	1918
Essex,	FREDERICK A. RUSSELL of Methuen,	1917
Franklin County,	GEORGE E. TAYLOR, JR., of Shelburne,	1916
Hampshire,	F. E. FARRAR of Amherst,	1916
Hampshire, Franklin and Hampden,	CLARENCE E. HODGKINS of Northampton,	1918
Highland,	JOHN T. BRYAN of Middlefield (P. O. Chester, R. F. D.),	1917
Hillside,	HAROLD S. PACKARD of Plainfield,	1917
Hingham (Agricultural and Horticultural),	U. S. BATES of Hingham,	1918
Hoosac Valley,	NATHAN B. FLOOD of North Adams,	1918
Housatonic,	CHARLES W. FREEHAN of Great Barrington,	1918
Lenox Horticultural,	ALFRED H. WINGETT of Lenox,	1917
Marshfield (Agricultural and Horticultural),	WALTER H. FAUNCE of Kingston,	1918
Martha's Vineyard,	JAMES F. ADAMS of West Tisbury,	1916
Massachusetts Horticultural,	EDWARD B. WILDER of Dorchester,	1918
Massachusetts Society for Promoting Agriculture,	N. I. BOWDITCH of Framingham,	1918
Middlesex North,	GEORGE W. TRULL of Tewksbury (P. O. Lowell, R. F. D.),	1917
Middlesex South,	JOHN J. ERWIN of Wayland,	1917
Nantucket,	HERBERT G. WORTH of Nantucket,	1918
Oxford,	WALTER A. LOVETT of Oxford,	1916
Plymouth County,	ERNEST LEACH of Bridgewater,	1917

		Term expires
Quannapowitt,	CALVERT H. PLAYDON, D.V.S., of Reading,	1916
Spencer (Farmers' and Mechanics' Association),	EDWARD WARREN of Leicester,	1916
Union (Agricultural and Horticultural),	HENRY K. HERRICK of Blandford,	1916
West Taunton,	CHARLES I. KING of Taunton,	1917
Weymouth (Agricultural and Horticultural),	THERON L. TIRRELL of Weymouth (P. O. South Weymouth),	1918
Worcester,	EDWARD A. WATERS of West Boylston,	1917
Worcester East,	ARTHUR C. HAWKINS of Lancaster,	1918
Worcester North (Agricultural and Driving Association),	HENRY D. CLARK, D.V.S., of Fitchburg,	1918
Worcester Northwest (Agricultural and Mechanical),	ALBERT ELLSWORTH of Athol,	1916
Worcester South,	WILLIAM E. PATRICK of Warren,	1916
Worcester County West,	JAMES A. RICE of Barre,	1917

The Commonwealth of Massachusetts.

THE SIXTY-SECOND ANNUAL REPORT

OF THE

SECRETARY

OF THE

STATE BOARD OF AGRICULTURE.

To the Senate and House of Representatives of the Commonwealth of Massachusetts.

Taken the country over, agricultural conditions during 1914 varied with the section and crop. Cotton, with an enormous yield in the south, is a drug on the market, while wheat, also a large crop, has not reached such a high level in years. Again, apples have not sold as cheap since 1896. These conditions were largely brought about by the European war now raging, and which has prevented the export of cotton to Germany, while it has created an unusual demand for wheat to countries whose ports are open. The apple market has been affected from a number of causes, chief among which are an over-estimate of the crop, poor grading, and to some extent lack of transportation facilities.

Massachusetts, not depending so much on one crop as some States, is, without doubt, in much better shape financially than those States whose prosperity is dependent upon the success of either potatoes, corn or cotton. Too much emphasis cannot be laid upon diversified agriculture for a State so situated as Massachusetts. Our soils vary in quality; our climatic conditions also vary, while our markets demand the greatest variety in food products. It would therefore be folly for Massachusetts ever to attempt to specialize in one crop. We should not attempt to become the greatest dairy State, or the greatest potato State, but rather, by adapting ourselves to the demands of our markets, seek to produce a higher per acre production of those crops which will return to us the most money.

General agricultural conditions are constantly improving, that is, our farmers in most sections are using machinery as far as possible in their farm operations, and are practicing crop rotation; are making better uses of fertilizers and their applications; are using better strains of seed; and are striving constantly to improve the quality of seed, breeds of cattle, and the fertility of the soil. At best, all of this is a slow operation, and immediate results are not possible. A prominent market gardener recently said that it took him five years to bring new land into a state of profitable productiveness, and this, in spite of the fact that he was using large quantities of manure each year.

Massachusetts agriculture has seen great changes in the past one hundred years, chiefly owing to the severe competition of States more favored than we are by climate, soil or transportation facilities for the production and distribution of some particular crop; but in spite of the loss of some crops and a great reduction in dairying, the State has advanced steadily in the value of its agricultural products since 1870, as the following figures will show: —

1879,	$24,160,881
1889,	28,072,500
1899,	42,298,274
1909,	60,000,000

We are fast moving from extensive to intensive agriculture, and several of our counties are among the most productive in the United States, based on the per acre production of improved land.

The values of farm products for our counties on this basis are as follows: —

Barnstable,	$38 67
Berkshire,	13 90
Bristol,	30 07
Dukes,	13 29
Essex,	34 08
Franklin,	30 07
Hampden,	23 32
Hampshire,	27 48
Middlesex,	35 39
Nantucket,	17 60
Norfolk,	32 93
Plymouth,	41 21
Suffolk,	137 43
Worcester,	22 40

One rather significant fact bearing upon the future of agriculture has recently come to your secretary's attention, namely, that from 1900 to 1910 the population of the State increased 561,070, or 20 per cent; the urban population increased 558,269, or 17.8 per cent; and the rural population 2,801, or 1.17 per cent. The number of farms decreased 798, or 2.1 per cent; acreage in farms decreased 271,123, or 8.6 per cent; and the improved acreage decreased 127,631, or 9.9 per cent.

In other words, an increased rural population of 2,801 on 271,123 acres less of farm land had to feed an increased urban population of 558,269. Of course, this is utterly impossible, and so Massachusetts continues to import her food supply. Our greatest need in the State is farmers, and if we cannot make farmers out of our own people, we must import them from wherever they can be found.

The resettlement of our land by people from other countries continues in some districts, notably in Barnstable and Bristol counties and along the Connecticut River; and we may look for a decided increase in immigration at the close of the war now raging in Europe. Does Massachusetts want these immigrants? It would seem to your secretary that she does, for undoubtedly many of them will be of a very desirable class and will come to make permanent homes. When this immigration begins, we should be in a position to offer these people facilities for finding agricultural opportunities, and sufficient credit to enable them to begin business, both of which subjects will be treated later in this report.

The Year's Crops.

Crop conditions in the State have been excellent the past season, and prices were normal until the outbreak of the European war, when prices for such crops as apples, onions and potatoes fell off. This was due to several causes, namely, the overestimate of some crops by the government, poor exporting conditions, lack of storage facilities, and also a tendency on the part of many farmers to rush all their crop to market at once, irrespective of grades.

Market gardeners have had a fair season with the exception of the fall and early winter, when lettuce as usual has sold very cheap. It would seem as if some action should be taken by the market gardeners to create a standard for this crop. Far too much light lettuce is put upon the market, and coming into competition as it does with a part of the southern crop, the southern lettuce is preferred owing to its greater weight.

Undoubtedly our market gardeners would secure a better price for their lettuce were they content to grow three crops instead of four, or, in some cases, two crops instead of three. Other market-garden crops were good, and on the whole prices were normal.

The onion crop in the Connecticut valley was fine, — the best in years, — but prices ruled low and may have some influence in reducing the acreage planted the coming season.

Tobacco in the Connecticut valley was good, and fair prices have been realized for the crop. Probably no crop in Massachusetts receives such careful, painstaking attention as does tobacco, grown as it is by a class of farmers highly skilled in this work, by study of soils and fertilizers, cultural, harvesting and curing conditions. They have brought this crop up to be one of our most profitable, and while the area in which it may be cultivated is restricted, still the per acre production is high.

In many sections old seedings and clover were severely injured by the deep freezing and severe winter weather, so that the hay crop was much reduced, and, although definite figures are not available at this time, the crop was probably less than in 1913.

While moisture conditions were good for starting the crop, those who did not cut their hay early lost heavily from bad weather at cutting time. The use of machinery in harvesting our hay crop is making it possible for us to grow more each year. The demand for home-grown hay is good, and prices were high.

The potato crop was large in size, but prices ruled low. This was due to a bumper crop all over the country and as far as prices were concerned, Massachusetts farmers fared better than those of most other States. In some parts of Vermont and New York, potatoes changed hands at 20 to 25 cents a bushel.

The severe winter wiped out our peach crop entirely, and in some places injured other fruit buds, such as plums, grapes and small fruits. The apple crop, however, was exceptionally large, and prices, except on the very best grades, were unsatisfactory.

The corn crop was good in most cases and ripened well, although in a few sections early frosts cut the crop somewhat. Abundant moisture in the summer gave a good crop of ensilage corn, and silos were well filled.

Reclamation of Waste Land.

A great deal is being said and written about getting certain classes of people in the cities back on the land, and a large number of well meaning but impractical people are advocating such measures, for which they are even going so far as to require State aid. These people do not seem to realize that it requires just as much training and experience, and perhaps a little more, to make successful farmers as it does to ensure success in any other profession. Any attempts of this sort should be confined to persons having had previous agricultural experience, or who have combined some system of training with their regular work, which would in some degree fit them for life on the farms. One feature in connection with this question is worth considering, and that is placing our unused lands in a condition where it will be possible for people of moderate means to take them up. Such work should be done by State institutions already in existence, as, for example, Bridgewater State Farm and other penal institutions. Land should be acquired, cleared, drained, and made ready for cultivation, and then sold for a price sufficient to cover the cost to the State; payments for this land should be extended over a series of years, with an added charge to cover interest, and the title should not pass from the State until all payments had been made.

FARM LABOR.

At the request of the Governor, this Board tried the experiment in the spring of placing some of Boston's unemployed men on farms. A number of these men came to the office and registered on May 21, and a list of their names, ages and qualifications was sent on May 26 to 650 of the larger dairy farms of the State. Up to July 6, thirteen inquiries were received by letter and six by telephone. Thirteen men were secured positions, and it is known that nine of the men kept them for less than three weeks.

This experiment was, of course, tried on too small a scale to draw final conclusions, but it does suggest one or two facts about the labor question. One is that the demand for help on farms is largely overestimated. Every year during the harvest season the newspapers publish stories telling of the thousands of men who will be needed to gather the crops, but when only twenty inquiries are received from 650 of the larger farmers of the State, it cannot be said that they are in a very desperate way for help. Not only uninformed persons but men right on the ground seem to overestimate the demand for farm labor. A good instance of this is the correspondence which this office had with the county agent for Orange County, Vermont. The agent said in his first letter that he could place 25 men in his section at $25 a month. When he came actually to get orders from the farmers, he was able to place just two. In a later letter he said, "I regret I cannot place some of the rest. I ran an advertisement in a local paper but *no one* has come forward with a request."

It also appears evident that no matter how small or how great the demand for help on the farm, it cannot be satisfactorily filled with the floating labor from the city, which has neither the training nor the inclination to do farm work. What farmers want are men who can milk and drive teams, and who in addition are temperate and want steady positions. It is perhaps regrettable but true that the unemployed of our cities do not fill these requirements. Most of this help which vibrates between shop and farm is of the poorest quality, but if it could be kept in one place long enough to give it adequate training, it might prove of some value.

Fertilizer Situation.

The war in Europe, and the consequent difficulty of producing and transporting certain fertilizing elements, particularly potash and basic slag, both of which are produced in large quantities in Germany, has resulted in a great shortage of both these products, but particularly of potash, and many farmers who have been used to mixing their own fertilizers from the raw products will find themselves more or less handicapped this year, principally with potash, as dealers are refusing to sell this product separately. There seems to be a fair supply of basic slag, and nitrate of soda is being offered at practically the same prices as last year. Most of the fertilizer dealers are offering mixed goods with a guarantee of 4 per cent of potash, and it will be necessary in most cases for farmers to buy these in order to get potash this season. Some chemists are advising the use of common salt, where no potash is used, applied at the rate of 500 pounds per acre.

The lack of potash in our country this year recalls forcibly to our minds the rather humiliating position that this country is placed in regarding this element, and of our almost complete dependence upon Germany and other countries for our supply. There are several sources of potash in our country and, no doubt, large deposits could be discovered were the matter taken up seriously by the government. Seaweeds of various kinds contain a large percentage of this element, and there are other sources which might bring a fair supply.

The future of agriculture depends upon conserving the fertility of the soil, and potash is one of the elements necessary to that conservation.

Basic slag, containing a large percentage of phosphorus, is also imported from Germany, while Germany takes large quantities of our rock phosphates. It would seem as if our farmers should use more of our natural rock phosphates, both treated and untreated, according to results desired. All farmers should avail themselves of the results of the latest experiments on the use of these phosphates, and a circular published by the Board on "How to Buy Fertilizers" should also be carefully studied. As the fertilizer question becomes more acute, as it is bound to do, we must depend more upon animal fertilizers and soiling crops for keeping up soil fertility, and in many places, not only in the country in general, but in our own State in particular, animal husbandry should be revived, and many of the practices now common in the congested areas of Europe will have to be adopted.

THE MILK SITUATION.

The charge has been made during the past few years that Boston is a closed market for the sale of milk, and that it is impossible to sell milk here on a fair competitive basis. Few people realize the amount of machinery and outfit necessary to handle milk in a safe way throughout the year; even the person or firm handling only a few quarts of milk must have the equipment for properly caring for this very perishable food. Therefore it is impossible for every farmer to maintain his own dairy outfit. Several courses are open to the farmer who wishes to raise milk: he can keep enough animals to afford to put in special dairy apparatus on his farm, and deliver milk to city or town customers direct, as is now done by quite a few; he may sell his milk to the dealer in the city who maintains a small dairy plant; or he may sell to the large contractors. Whichever course he may pursue, he has as free a market as does the farmer who sells fruit or vegetables, for both these latter products are in direct competition with similar products from other States and from our own State.

Along with milk production in some sections of this State should go the raising of dairy cattle, in order that it shall not be necessary for the farmer to purchase new animals each year, but by producing his own, derive the benefit of this profit. High-grade animals should be produced, as it costs as much to raise a scrub as it does a cow producing 8,000 pounds of milk; and no farmer in our State can afford to keep a cow which produces less than 6,000 pounds of milk per year.

Dairy animals will come back in this State if our farmers find that they can make a greater profit in them than from other kinds of agriculture, but it would be the height of folly to attempt to impose on this State the production of a commodity which farmers in other States are willing to produce at a loss or may possibly produce cheaper.

The inroad of the foot-and-mouth disease has resulted in the killing of about 1,200 dairy animals in the State, but this condition has not materially affected the dairy situation.

The agricultural history of Massachusetts would show an ever changing type of farming. We learn a great deal about the loss of dairy cattle in our State, and the consequent reduction in the amount of milk produced. Some people are inclined to look upon this as the whole agricultural question, not realizing that beginning a few years after the first settlements were made, Massachusetts agriculture has undergone great changes. The great crops of grain, beef and mutton have been grown here in sufficient quantities to feed our people, but as new lands were opened up and cheaper transportation became possible, these crops followed the lines of the cheapest production and forced our people to grow something else. So it has become with dairying; the farmers of Vermont, New Hampshire, Maine and Canada feel that they can produce milk at prices which dealers are willing to pay, therefore if we cannot meet these prices, we shall have to go into other lines of agriculture, or produce milk of a higher quality for which our people must pay a fair price commensurate with the cost of production.

State Ownership of Stallions.

Massachusetts has never been a great horse-breeding State, but we have got to come to it sooner or later, and now that the terrible war in Europe is fast depleting the horses of the countries engaged in breeding them, and these countries are drawing heavily upon the United States to keep their stock replenished, a more fitting time for us to attempt a revival of this important industry could not be found.

Undoubtedly the principal drawback to horse breeding here is the lack of stallions, and the practical problems surrounding their ownership and use by the farmer. No farmer can afford to own a stallion, as he would a bull, and few farmers can afford to pay the rather large fee charged by the owners of the few stallions in the State. New Jersey has tried the experiment of State ownership and so far with success. Massachusetts should try this also, and to this effect a bill has been drawn for presentation to the Legislature.

SHEEP.

In connection with this subject quite a study of the dog laws of various States and other countries has been made by your secretary. The Hampden County Improvement League is much interested in the subject of better dog laws, and a law prepared by them has been introduced into the present Legislature.

WILD DEER.

The law passed last season relative to the better control of these animals has had a marked effect in reducing them and their consequent damage to our orchards. The Board should oppose any attempt to repeal this law, and should possibly attempt to have the open season extended.

ALFALFA.

This very important crop is not meeting with the success which it ought to in our State, and it would seem that it is largely due to lack of knowledge regarding the growing of it. The Board, in conjunction with other organizations interested in this subject, should appeal to the government and the State experiment station in order that a sub-experiment station for the growing of this crop be established in Massachusetts. Much alfalfa is now being brought to our State from Texas and California, while we have much land which could grow it. There is no doubt that it would pay if grown only as a one-season crop, as we do Hungarian barley or oats, planting the cheaper varieties of seed in the spring, getting if possible two cuttings which may be fed green or put in the silo. We must not give up the attempt to grow alfalfa, for we are bound to succeed if we persist.

Roads and Transportation.

The State should extend its highways as rapidly as possible in order to connect sparsely settled districts with large centers. Much of the transportation of the future in our hill towns must be done by motor truck and auto, and the use of these vehicles and the consequent better service to the people in these districts should be hastened by the construction of better roads. Not only should the State construct better main highways, but it should assist the towns in building better connecting roads by reducing grades, improving bridges and culverts, to accommodate the new methods of transportation.

The report of the Massachusetts Highway Commission says: —

> There are now in the State 1,039.07 miles of State highway. During 1914, 76.16 miles of State highway were constructed. Under the provisions of the "small town" act, roads were constructed in 91 towns, and contracts were made but not completed in 18 towns.
>
> Engineering advice has been given in 48 cities and towns on work where the State made no financial contribution.
>
> Work has been done, under the provisions of chapter 525 of the Acts of 1910, in 66 towns.
>
> The total number of towns and cities which have received aid from the State during the year 1914, either by the construction of State highways, construction of roads under the "small town" act, or the improvement of roads under the provisions of chapter 525 of the Acts of 1910, is 207.

The increased use of the auto truck is very apparent throughout the State, and in many places it has already taken the place of the horse for hauling farm produce to market, and we may look for a greater use of the truck just as soon as roads are extended and new land developed.

Markets and Marketing.

This subject, which is far too apt to be a secondary one when considering agricultural operations, is really the key to success in the whole question. We may grow good crops, pack them well, and get them to the market, but if we do not have the ability to sell, or the market acquaintance, very often the price received for our goods does not compensate for cost of production.

The first step in good marketing is good grading laws, and the second is strong selling organizations.

The products of our Massachusetts farmers, subject to no grading laws or regulations, come in competition with those of other States where either State laws or co-operative association regulations have fixed a standard which insures the buyer against careless handling and poor grading. The regeneration of Massachusetts agriculture will not come until we make some attempt to better the marketing conditions. It would therefore seem proper at this time to request the Legislature to establish a bureau of markets, whose duties shall be the fixing of standard grades, enforcement of grading laws, assisting in the formation of selling organizations, giving the farmers reliable information in relation to markets not only in this State but in others. This bureau should become a clearing house for information on all marketing questions, and would be of untold value to our farmers.

The question of a law to license commission men has come up several times during the past year, and a bill was introduced into the last Legislature relative to the subject. This bill was not supported even by its introducer, and it would therefore seem as if the case were not sufficiently acute to warrant any such law. Investigation of this question ought, however, to go on, and if such a law is necessary, it should be enacted. Many of us are far too apt to feel that a middle man is not necessary in the sale of our products, little realizing that we often act as our own middle man and far too often to the detriment of our growing crops. Sales companies and co-operative associations controlled by the farmers should be established, with the State Bureau acting as a clearing house for them.

A bill to require all cities and towns of over 10,000 inhabitants to provide suitable marketing places where farmers may sell direct to consumers has been introduced on recommendation of a member of the Board.

THE NEED OF AGRICULTURAL GRADING LAWS.

The large apple crop of 1914 demonstrated more than ever before the need of some grading laws in the State. Maine has been working under an apple-grading law for four years. New York passed one last year, and Canada has had one for over eight years. From all these sources come only good reports. Nova Scotia says it has raised the price of her apples abroad over $1 per barrel. The same is true of Maine, and dealers in New York say that Baldwin apples, packed under their law, have brought from 65 cents to $1 a barrel more than have Baldwins from Massachusetts. We must adopt such a law sooner or later if we are to compete with the other States, and as all these laws are designed to cover only those apples packed in closed packages and to enforce a true marking of them, it will not interfere with the person who still wishes to pack any old way, except that he must mark his apples "ungraded" or "unclassified." The open package is not affected by the law.

The Boston Chamber of Commerce has recently appointed a committee, composed of persons representing all branches of the apple industry, to draft a law which may be made uniform in all the New England States, and this committee has devoted a great deal of time and thought to the matter. The law which it proposes to introduce will be based on the best points of all the laws so far enacted. Your secretary is a member of that committee, and has already introduced a bill which may have to be revised in the legislative committee later on, the committee on grading not being ready to report just yet.

Not only apples, but many other farm products, should come under such laws. We cannot expect to sell in large quantities until we can get large quantities of one grade. Never was this more strikingly illustrated than last fall when the Board, desiring to help in the sale of apples, started the "buy a barrel of apples" movement. Orders came in very fast, and were turned over to the secretary of the Massachusetts Fruit Growers' Association. Difficulty was experienced in finding enough growers who were packing in uniform grades to fill the orders received. Here is another instance of the value of a grading law. A Boston concern, wishing to give away a barrel of apples with each purchase, was forced to send to Maine to get enough apples of one grade to fill the orders.

RURAL CREDITS.

In the secretary's report for 1913, among general recommendations was this phrase: "A system of banking must be established whereby farmers may obtain money on as easy terms as other business men do." In connection with this, the Legislature, on recommendation of the Board, passed a law extending the scope of credit unions (and there is no doubt that sooner or later advantage will be taken of this by some classes of our farmers); but we need a more far-reaching law, a law which will be of greater advantage in developing our now unproductive land and financing new agricultural development. This is particularly necessary at this time as it seems probable that the government will not pass any such legislation; and even should it do so, it will not interfere with a sound State law. To this end, your secretary has studied at length the New York land bank law and, after consultation with authorities in New York and the Bank Commissioner of our State, has decided to introduce this law at this time to the Legislature, believing that in so doing there will be established a system of banking which will materially aid the farmer.

Other States are about to pass such laws, and the national Secretary of Agriculture speaks of such legislation as follows: —

> It is the judgment of the best students of economic conditions here that there is needed, to supplement existing agencies, a proper land-mortgage system, operating through private funds, just as other banking institutions operate, and this judgment is shared by leaders of economic thought abroad. The national banking system up to the present time has labored under restrictions imposed by law which made it impossible for the national banks to solve the problems in the most effective way. State banks, with fewer restrictions, with smaller capital requirements, and ability to lend on real estate, have established more intimate touch and have perhaps rendered greater assistance.

The proposed law provides for the creation of a State land bank, made up of associations who subscribe the capital, on the same basis as the building and loan associations. Loans are to be made on farm lands to the extent of 60 per cent of their value, with the understanding that the money is to be used to improve the land. In order to create additional funds in the bank, debenture bonds are to be issued upon the mortgages held, and these bonds offered to the public. These bonds would become a safe and, no doubt, attractive form of investment as there would be back of them actual land values. The whole system contemplates supervision by the Bank Commissioner, and once well established, will undoubtedly systematize credits in rural districts and materially reduce the rate of interest.

Advertising Massachusetts Agricultural Resources.

What was said last year in the report of the secretary relative to this subject holds more true to-day than ever. Massachusetts took the lead among the eastern States on this subject in 1908, and since then other States have followed along the same general lines. New York publishes a book of over 600 pages on her agricultural resources and farms for sale. There seems to be a feeling on the part of some farmers that the advertising of our land will cause greater competition among us. This does not seem true, however, when you stop to consider that the competition will only be transferred from interstate to State competition. In other words, we are now importing practically two-thirds of all the food products we consume. Our farmers are competing with New York, New Jersey and other States in the same products which can be grown here just as well as in the sections mentioned. We want the farmers from those other States to come here and take up our land and grow these crops, thereby increasing the valuation of our State, and, furthermore, keep in Massachusetts money which is now going out of the State.

In this connection, a bill has been drawn to cover not only the publication of the bulletin on Massachusetts agricultural resources, but also providing for the collection by the Board of data relative to Massachusetts agriculture as will be of benefit to us. As an example of the kind of work contemplated, it is desirable that we should know more about the production of apples in the State; and it is proposed under this bill to take an apple census and to follow this up each year with an estimate of the crop based on actual knowledge of the number of bearing trees in the State. Massachusetts and the country at large suffered untold loss this year from the overestimation of the apple crop, based on the government figures, for this estimate had the effect of depressing prices and causing farmers to sacrifice their apples. Once the apple census was carefully made, other crops could be taken up.

In connection with this work, the State would have the advantage of being able to use the large relief maps prepared by the Board for the Panama-Pacific Exposition, and such data as is collected may be placed on the maps from time to time. In this way, it would be possible in a few years to have a complete map for each crop, showing its distribution and the exact number of acres devoted to it.

Reclamation of Wet Lands.

The bill presented to the Legislature last season, making some changes in the act of 1913, providing for the reclamation of wet lands, was enacted into law, and the sum of $10,000 added to the appropriation. The joint committee investigated tracts of land in the following towns: Acton, Bridgewater, Carlisle, Concord, Randolph, Sturbridge, Walpole and Wayland. Several detailed surveys were made and definite plans laid to start work when the Board of Health was reorganized, and a ruling of the Attorney-General brought the work to a close early in the summer. As the Department of Health has only recently become organized, no new work has been undertaken. Therefore there remains now an unexpended balance of $24,547.55. Where large tracts of land are to be drained, it will undoubtedly be found wise to follow such a law as Illinois and other western States have adopted, that is, to provide for the deepening of the main stream or else make a new channel which will give land owners a chance to drain into the main water course. The expense of the whole operation should be charged to the acreage affected over a term of years long enough not to make it a hard load for the farmer to carry.

Exhibit at the Panama-Pacific Exposition.

The Board of Panama-Pacific Managers turned over to this Board $5,000, to be used in making an agricultural exhibit at the exposition, and after several conferences with the Board it was decided to make such an exhibit.

A committee, composed of Messrs. Albert Ellsworth, Calvert H. Playdon, F. W. Rane and F. P. Newkirk, was appointed at the summer field meeting, June, 1914, and a plan already mapped out was decided upon, namely, to collect data relative to Massachusetts agriculture, consisting of pictures, maps, charts and booklets, designed to call attention to the agricultural possibilities in our State. The State forestry department was also given some money, and it was decided to combine the exhibits. Mr. Warren H. Manning was retained by the committee to perfect the plan, which was as follows: —

That two large relief maps of the State should be made, one showing conditions much as they are, the other showing to what agriculture and forestry development should lead. The Board may be congratulated on having secured Mr. Manning's services, for with his great knowledge of conditions in the State, and the help of other departments, we have been able to collect more data in one place relative to the resources and conditions of the State than was ever before brought together.

Other features of the exhibit are pictures of all phases of Massachusetts agriculture, which are to be shown in an automatic machine, as well as moving pictures of actual farm operations on Massachusetts agriculture; road and railroad maps and an exhibit of old agricultural tools make up the balance of the display which will undoubtedly form a unique feature of the exposition. A splendid location at the exposition has been secured in the agricultural building, and the exhibit is well on its way at this time.

Horticultural Exhibit.

In addition to the agricultural exhibit, your secretary was requested by the Board of Panama-Pacific Managers to get together an exhibit of Massachusetts horticultural products, and as our State is producing a great deal of the best ornamental nursery stock grown in the country, it was decided to plant a Massachusetts garden on the exposition grounds. A committee composed of Messrs. Roland, Finlayson, Farquhar, Wyman and Shea, was chosen by your secretary, and stock was collected from the following growers: —

Thomas Roland.
Cherry Hill Nurseries (T. C. Thurlow & Sons, Inc.).
R. & J. Farquhar & Co.
Edward Gillett.
Old Colony Nurseries, Inc.
Edward F. Dwyer & Sons.
George B. Eager.
Peter Fisher.
Patten & Co.
Bay State Nurseries.
J. K. Alexander.
George H. Walker.
Eastern Nurseries.
New England Nurseries.
Frederick J. Rea.
Forbes & Keith.
J. Woodward Manning.
Breck-Robinson Company.
E. L. Lewis.

Mr. Carl Purdy of Ukiah, California, was retained as landscape architect in California. The garden has been planted successfully, and Massachusetts had the honor of being the only State having such a design on the grounds.

In addition to this work, shrubs and flowers were planted about the State building. For all this work, the Board will receive due recognition by the authorities at the exposition.

The relations between your secretary and the Board of Panama-Pacific Managers, as well as with the authorities in California, have been most pleasant, and while the work has made many exacting demands upon his time, the data collected and the work done will be of great value to the State for all time.

Insect Pests.

Undoubtedly the most serious insect pest of the year was the army worm, which appeared in large quantities in some parts of the State during late July and early August. The principal places attacked were: —

Abington.
Arlington.
Athol.
Attleborough.
Barnstable.
Berkley.
Boston.
Bourne.
Braintree.
Brewster.
Brighton.
Brockton.
Carver.
Chatham.
Chelmsford.
Cohasset.
Dartmouth.
Dighton.
Duxbury.
East Bridgewater.
Easton.
Edgartown.
Fairhaven.
Fall River.
Falmouth.
Gloucester.
Halifax.
Hanover.
Hanson.
Harvard.
Harwich.
Hingham.
Holbrook.
Hyannis.
Longmeadow.
Mansfield.
Medford.
Middleborough.
Milford.
Nantucket.
Newbury.
North Andover.
Northbridge.
Norton.
Norwell.
Oak Bluffs.
Pembroke.
Plymouth.
Plympton.
Raynham.
Rochester.
Rockland.
Rockport.
Salisbury.
Scituate.
Seekonk.
Somerset.
Swansea.
Taunton.
Tisbury.
Topsfield.
Wareham.
West Boylston.
West Bridgewater.
West Tisbury.
Weymouth.
Whitman.
Worcester.

Reports of enormous losses have been numerous from many places, but personal visits to some of these have failed to indicate any very great amount of destruction. Examination of many places where the loss was estimated at as much as $500 leads to the opinion that one-fifth of this amount would be more nearly correct.

A member of the State Board who visited various parts of the towns of Bridgewater, Middleborough, Wareham, Carver, Plympton and Plymouth during the height of the invasion this year has supplied the following statement: —

> At the Bridgewater State Farm the army worms were very numerous, though Mr. Bacon, the farmer there, stated that the attack was not as bad as in 1896. The greatest injury was to oats and grass, and would perhaps reach $500. There were several smaller outbreaks in Bridgewater, but with slight money loss. Middleborough had numerous though small outbreaks, the total loss being estimated at $300. In Wareham, some lawns and small fields of grass were injured, the estimated loss being less than $100. Reports of damage to cranberry bogs in Carver failed to be supported on investigation; a few mowing fields attacked indicated a loss of perhaps $100. In Plymouth, no places were found where the insect was causing any appreciable injury. In these towns the whole question of damage has been much overestimated without question, for all cases reported were followed up and always found to be much exaggerated.

A bulletin on the army worm, its habits, history and an account of the recent outbreak, has been prepared by Dr. H. T. Fernald, and is a splendid treatise on the subject.

Tent caterpillars were not so numerous as last season, but in some parts of the State did considerable damage; 1913 probably marked the height of the present cycle of this insect.

Forest tent caterpillars were abundant in some places, and their work is often mistaken for that of the gypsy moth.

Brown-tail moths were very scarce in most sections, and reports are now coming in that the webs made last year contain very few live insects.

Orchard insects, such as codling moth, railroad worm and leaf miners were not as numerous as usual. Good conditions at time of spraying probably reduced the number of codling moths, so that there was a small second lot, although in some sections this pest was serious.

One of our most troublesome orchard pests is the aphis, and when these are plentiful, as they were during the past season, much damage is done. As they are sucking insects they are more difficult to destroy than leaf-eating insects, and particularly so as they work when the tree is in leaf and continue their depredations during the entire growing season. The greatest damage done is the checking of tree growth, reducing the size of the fruit and causing it to be much discolored.

Scale insects are still rapidly killing our neglected orchard trees, and the greatest danger from this pest is the spread from neglected orchards to those given good care by the owners.

The whole insect question is one which should have deep thought. We are bound to have a bad outbreak of some insect each year, for conditions governing their control by parasites are such that some years the parasites are killed; and there has not been any means yet devised by which human agencies can completely control serious outbreaks. A greater knowledge of parasites would be of untold value to us, and the breeding of them will undoubtedly be an economic possibility in the near future.

Nursery Inspection.

The inspection of our nurseries for dangerous insects and plant diseases has been conducted in a very efficient and effective manner. The work of Dr. Fernald and his assistants has been of the highest order, so much so that our certificates of inspection are accepted by all States.

In connection with this, your secretary would like to call your attention to a question which is bound to have some influence upon the future of the fruit industry of the State, and that is the importation of fruit grown in South Africa, New Zealand and such countries. These fruits, coming from countries where conditions are similar to ours, may carry insects and diseases new to us, and should be inspected before being sold in the State. Western States have taken very definite precautions to guard against such dangers, but we in Massachusetts are inclined to take the precaution too late. A bill for presentation to the Legislature has been drawn covering the necessary points, and an additional appropriation of $2,000 asked for to do this inspection.

Apiary Inspection.

This department has performed its work in a very satisfactory manner, and has covered much new territory which it has been impossible to reach in other years owing to the small force of inspectors. It is gratifying to know that in sections where this work has been going on longest, bee diseases have practically been wiped out; and just as soon as we can better control the shipment of bees into our State, just so much sooner may we expect to keep the State entirely clean. To this end it is recommended that an amendment to the present law be enacted providing that transportation companies, common carriers and other persons bringing broods of bees into the State be required to notify the State Inspector of Apiaries immediately of such shipments in order that, if deemed necessary, they may be inspected. It is also recommended that the salary of the State Inspector of Apiaries be fixed at $500 per annum instead of $5 per diem as at present. This will accord with the nursery inspection law. The department is asking for $1,000 more this year to carry on the work, as a larger force of inspectors is necessary in order to cover the ground quickly.

The Dairy Bureau.

The Bureau has been particularly active the past season, and its work is becoming more and more effective. Cases of fraud against the dairy laws have been prosecuted vigorously, and while old offenders of this type are driven from their ways, there seems to be a certain number of new ones always coming along. The second year's work on encouragement of dairying will be reported fully by the Bureau. Mr. Harwood, the general agent, was sent to Europe to study dairy conditions there, and while he was able to visit only the Channel Islands and Great Britain, owing to the outbreak of the war, his trip was of great value, inasmuch as he was able to compare conditions with a first-hand knowledge. Mr. Harwood has also visited some of the New England States in connection with the Chamber of Commerce investigation, and is contemplating a trip through southern Canada in the spring. We have got to know more about conditions surrounding us, for the future of dairying depends much upon this knowledge. It would be unwise for us to advocate ordinary dairying if we find upon investigation that market milk can be produced cheaper in other States which are within hauling distance of our markets.

The State Ornithologist.

The State Ornithologist has this year been investigating very thoroughly both the cat and the rat, and while they may recall vividly to us visions of our primer days, they nevertheless have a very decided influence upon our bird life. Mr. Forbush's investigations on the rats have been summed up in a bulletin on the subject which is now ready for distribution. This bulletin treats the question from every possible angle, embodying many new ideas, and bringing together more material on the subject than has ever been collected in one publication.

His investigations in regard to cats are not complete as yet, but data obtained will, no doubt, be of service in determining the economic value of this animal.

Various other matters connected with bird and animal life have been investigated by Mr. Forbush, and these will be embodied in his report. The sale of the special reports by Mr. Forbush for the fiscal year ending Nov. 30, 1914, has been as follows: "Useful Birds and their Protection," 594; "Game Birds, Wild Fowl and Shore Birds," 267.

The State Forester.

A new commission, created by the last Legislature to buy lands for reforestation, has given the State Forester another duty, as he is a member of this commission.

The work of suppressing the gypsy and brown-tail moths has gone on as usual. Parasites have been liberated and certainly they have done good work, particularly so the Colosoma beetle, which feeds upon the larvæ of the gypsy moth, in particular. This parasite in turn is preyed upon by the skunk, and in some sections where skunks are plentiful, it is much reduced by them. The removal of the broad-leaved trees, which are the common food of most of the forest insects, will greatly reduce the number of these pests simply by reducing their food supply.

Forest fires have been controlled well during the year, and only once during the shooting season, when the woods were dry, did they do great damage.

Reforestation is going on as rapidly as funds are available. The planting of these new forests, particularly of pine and other evergreens, and the cutting of our hard woods, will before long have a marked effect on the destruction of our woodlands by insects.

The Fairs.

Probably never in the history of the fairs of the State has there been such universally good weather through the entire season. The only fairs which suffered were those held during the early part of September, when cold, windy weather prevailed. The balance of the month was warm and dry, and the attendance at practically all the fairs was good. Exhibits in most cases were excellent, and it is gratifying to see in many cases a return of interest in the exhibition of beef producing animals, such as were shown at Greenfield, Worcester and Charlemont. At present there seems to be a growing tendency to make a specialty of one breed of animal at a fair; and it would appear to be a step in the right direction, as a certain fair should be known as the Guernsey fair, another as the Holstein fair, etc. If our fairs are to accomplish the greatest good, they should become centers of buying and selling, and if one breed of animal can be concentrated at one place, exchange in these animals would be facilitated.

It is pleasing to note that in many cases our fairs are shutting out the fakirs and are striving to get attractions of a higher class, designed to return a profit to the fair management rather than to the fakir. All of the incorporated societies, with the exception of Spencer, held fairs this year, and many unincorporated organizations. A large number of towns celebrated the gathering of the harvest by holding a fair, and it is an institution which certainly should be commended; for what could be more appropriate at such a time than an exhibition of the products of the farm for friendly competition, and a gathering together of the people in sympathy with a common interest? Fairs have always marked a cycle in the farm year, and to abandon this annual event would be a regrettable step, removing one of the things which stimulate the farmer to produce his best, and taking from him a favorable chance to compare his efforts with those of his neighbor.

It would seem advisable that the premium lists of the various fairs should be revised and standard lists of fruits, flowers, vegetables and stock furnished, so that each society may choose from this list such things as would best be encouraged in its section.

Twenty-six States in the Union are now offering prizes at their fairs in "better babies" contests. Only one society in Massachusetts has taken up this work, but with a degree of success which has made these contests one of the features of the exhibition. It would seem to your secretary that while we are giving so much attention to the care and feeding of stock and the growing of crops, it might be well to consider the larger question of developing strong and healthy children, as these should be the best crop of the farm. These contests are conducted just as stock judging contests are. Points scored are for development and not for beauty. Directions are given to parents as to the care and feeding of children, and, in other States, such contests have had a marked effect upon the development of the child. This question is so closely connected with that of milk production and its use, that it would seem advisable for us to favor any plan which would lead to a more sane use of milk in the home.

Institute Work.

A vote of the committee on institutes and public meetings, and later confirmed by the executive committee, has made it possible to carry out a circuit of institutes, as outlined in my last report. Arrangements for working out such a plan are under way, and it is hoped that it may be carried out this winter. There is a growing demand for these institutes from all sorts of organizations, and if the Board had the necessary appropriation, more than double the work could be done.

Your secretary attended the annual meeting of Farmers' Institute Workers in Washington, and found that in comparison with the amount of money spent, we are getting as good results as are other States. There is, however, a growing feeling among institute workers that the extension departments of the colleges are looking with eager eyes upon this work, and are demanding that it be placed under their control. It may be that in some States this is desirable, but your secretary feels that it would be unwise for the Board to give up this work. Many questions enter into the extension of these institutes, and all involve more money. We could do much better work with a paid leader who could devote his whole time at least three months in the year to the work. Lectures illustrated by stereopticon and moving pictures are as a rule more instructive. The Board should make a series of moving-picture films of all Massachusetts agricultural operations and have them for use at all times. Those used the past year belong to the Board of Panama-Pacific Managers, and wherever they have been shown much interest has been displayed.

The total number of institutes for the year was 161, with 188 sessions, and the total attendance was 22,649, or 120 per session, against 115 last year, 118 in 1912 and 126 in 1911. One of the societies held 8 institutes; two held 5; four held 4; eleven held 3; seven held 2; five held 1; five held none, and 75 institutes were held by organizations not represented on the Board.

Poultry Premium Bounty.

The bounty annually appropriated for the purpose of reimbursing poultry associations applying therefor, to the extent of their expenditures in premiums for the breeds specified by the Board, was distributed as follows: —

Attleboro Poultry Association,	$130 64
Dalton Poultry, Pigeon and Pet Stock Association,	167 09
Eastern Massachusetts Poultry and Pigeon Association,	105 77
Holyoke Poultry and Pet Stock Association,	248 76
Lawrence Poultry, Pigeon and Pet Stock Association,	49 76
Lenox Poultry Association,	101 38
Mansfield Poultry, Pigeon and Pet Stock Association,	46 00
Milford Poultry Association,	213 88
New England Poultry Association,	191 50
Northern Berkshire Poultry Association,	173 54
Springfield Poultry Association,	300 00
Worcester Poultry Association,	253 14
Total,	$1,981 46

The law regulating the distribution of this bounty was amended so as to conform more nearly to that applying to the agricultural societies. The limitation of the period within which associations must hold their shows was extended from three months to the whole year and June 30 was set as the close of the year. The date of filing returns was definitely set as July 10, and bounty was made payable in August instead of September. The basis on which the bounty due each association is to be reckoned was changed from the amount of entry fees taken in to the amount of money paid out in State premiums for such breeds and strains of poultry as the Board considers most worthy of encouragement. The term "State premium" was defined as a premium described in the premium lists of the associations as being offered by the Board through the association. By a ruling of the Board associations can be reimbursed only for first premiums.

Boys' and Girls' Agricultural Work.

The Legislature granted $1,000 additional for this work last year, and the immediate results are very apparent, inasmuch as over 40,000 boys and girls were enrolled in potato, corn, canning and other clubs. State-wide contests in all branches of garden and farm work have been held, and a great stimulus to the youths of our State to go into agriculture has been given. Professor Morton, of the agricultural college, who has had charge of the work under Professor Hart, will report to you more fully.

Special Exhibitions.

A number of exhibitions of farm products have been held by the Board during the past year, and at several held by other organizations the Board has offered prize money or cups. Two noteworthy points about all these exhibitions should be mentioned: first, the high quality of the entries has shown that the best of our Massachusetts farmers can produce as good corn, fruit and dairy products as any State in the Union; second, a comparison of the exhibitions of this year with those of five and six years ago shows that there has been a rapid improvement in the quality of exhibits.

The first apple show of the year was that of the International Apple Shippers' Association at Boston, in August. For this the Board collected a small exhibit of early varieties of apples to represent Massachusetts. This exhibit made a good showing though it was, of course, at a disadvantage as compared with some other States on account of the early date of the convention and the fact that very few of our apples had reached their full size and color.

The Board exhibited 100 boxes of Massachusetts grown McIntosh at the pure food and domestic science fair which was held at Mechanics' Hall in October; and appropriated money for the Massachusetts prize winners at the New England fruit show at Providence, in November.

In connection with the public winter meeting at Worcester, the Board offered $300 in prizes for a corn show, which was judged by Professor J. A. Foord of Amherst. There were 40 contestants and a creditable display of both flint and dent corn.

The same amount was appropriated for an apple show, which was judged by Professor F. C. Sears of Amherst. There were thirty-five contestants, and the quality of the fruit shown was uniformly excellent. Knowledge of box packing is becoming more widespread among our growers, although there is still large room for improvement here. One class which brought out some interesting entries was that for the most attractive and practical retail package for apples; and considerable ingenuity was shown by exhibitors in contriving packages which would stand shipping, be neat, convenient to carry, and tasteful enough to catch the buyer's eye.

Five hundred dollars was given by the Board to the Massachusetts Dairymen's Association for exhibitions of dairy products. With this money two shows were held, — one at Amherst, in connection with farmers' week, and the other at the public winter meeting at Worcester. Both were very successful, largely due to the efforts of the secretary of the association, Professor W. P. B. Lockwood of Amherst.

An exhibit of boys' and girls' home and school garden club work was also held at the Worcester meeting, and the showing of the coming generation of farmers was most praiseworthy. All parts of the State were well represented. A further description of the work of the boys' and girls' clubs during the year will be found under that heading.

Cups were offered in the students' apple judging and packing contests, and great interest was manifested in these. A cup was also awarded for the best exhibit of apiary products at the New England fair at Worcester.

Cups were offered for best window displays of apples in Boston and Brockton, and prizes awarded in the boys' stock judging contest at Lowell.

Meetings of the Board.

The Board has held its regular meetings the past year. The annual meeting was in January, at which the routine business of the year is done, reports read, and legislation decided upon. The summer meeting was held at Hood Farm, Lowell, on June 24, and in spite of a hot day a very large number of people gathered to listen to a most interesting program.

Discussions on spraying, marketing and swine raising, together with demonstrations of irrigating appliances, the use of dynamite in agriculture, and boys' stock judging contest, completed a profitable day. The Board gave a hearty vote of thanks to Mr. Hood for his hospitality.

In July a most successful dynamiting demonstration was held at Valley Field Farm, Lexington, at which more than 300 persons were present.

The winter meeting of the Board was held in Worcester in the rooms of the horticultural society, in co-operation with the Worcester Horticultural Society, Worcester County Improvement League, Massachusetts Dairymen's Association, Massachusetts Milk Inspectors' Association, New England Alfalfa Growers' Association and other organizations. The subjects discussed were poultry, market gardening, fruit growing, raising beef cattle, home economics, milk production, alfalfa, and farm accounting. All sessions of these meetings were well attended, the average being over 200. The splendid spirit of co-operation manifested by all the organizations, the desire on the part of the citizens of Worcester, and particularly the Worcester Chamber of Commerce, to make the meeting a success, marks one of the bright spots of the year in agriculture.

Various exhibitions of corn, fruit, dairy products, boys' and girls' garden products, and the sediment cottons of the clean-milk contest, served as an added attraction.

Moving pictures of Massachusetts agriculture were shown between the lectures, and these being more or less of a novelty at such a meeting were much enjoyed. The future success of such meetings depends largely upon the co-operation of all organizations, and, wherever we may go, it is hoped that the same spirit will prevail as in the past.

For the first time attention has been called to the provisions of chapter 452 of the Acts of 1910, which require that all State boards and commissions shall deposit with the Secretary of the Commonwealth, on or before the first Wednesday of January in each year, such parts of their annual reports as contain recommendations or suggestions for legislation, which are to be accompanied by drafts of bills or resolves embodying the legislation recommended.

It is apparent that the enforcement of this provision will necessitate a meeting of the Board on a date prior to the first Wednesday in January. It is therefore recommended that the date of expiration of the terms of members be set on the first Tuesday of December, thus allowing the annual meeting to be held at that time. A corresponding change in the time of holding the public winter meeting will be necessary, and it is recommended that the by-laws of the Board be amended so as to allow the date of this meeting to be set each year by the Board.

Co-operation with Other Organizations.

During the past year the Board has enjoyed very pleasant relations with various other organizations. The mutually helpful co-operation between the Board and the agricultural college has been maintained, and many of the professors have been engaged to work with the Board at exhibitions, institutes, and in various other ways.

The grange has also co-operated in many ways, particularly in the institute work, where our speakers acting jointly with the grange have addressed large audiences.

The Boston Chamber of Commerce, through its agricultural committee, has many times co-operated with the Board, particularly in the matter of collecting data relative to the milk and fruit questions; and your secretary has attended a number of meetings held by the Chamber, and is at present a member of the committee appointed by the Chamber to formulate an apple-grading law.

The Massachusetts Dairymen's Association, the Massachusetts Milk Inspectors' Association, the Massachusetts Fruit Growers' Association, the Worcester and Hampden County Improvement Leagues, the Worcester Chamber of Commerce, the Worcester County Agricultural Society, and many other organizations have united to assist in the work of the Board, and to all these the Board wishes Godspeed.

Changes in the Board.

The expiration of terms resulted in the following changes in the personnel of the Board: Mr. Rufus M. Smith, of the Hampshire, Franklin and Hampden Society, retires after three years of service, and Mr. Clarence E. Hodgkins has been elected to fill his place; Mr. Abner Towne, of the Hoosac Valley Society, retires after three years of service, and Mr. Nathan B. Flood has been elected from this society; Mr. R. H. Race, of the Housatonic Society, retires after three years of service, and Mr. Charles W. Freehan will assume his seat; Mr. George F. Morse, of the Worcester East Society, retires after six years of service, and Mr. Arthur C. Hawkins has been chosen his successor; Mr. L. E. Fletcher, of the Worcester North Association, retires after three years of service, and Dr. Henry D. Clark has been elected to the Board in his place. The vacancy caused by the deposition of Mr. Fred F. Walker as Commissioner of Animal Industry will be filled temporarily by the acting commissioner, Dr. Lester H. Howard.

Work of the Office.

The added interest in agriculture among the people and the increased activities of the Board are directly reflected by the greater demands on the working force in the office of the Board. Each new project requires original thought and investigation and more or less correspondence. The work of editing and supervising the printing and distribution of the numerous publications, the constantly increasing requests for information on every conceivable subject relating to agricultural opportunities, farms and farm lands, live stock, crops, and the like, answers to many of which require some investigation and lengthy letters, and the collection, compilation and filing of data of all kinds, besides the indexing and care of a circulating and reference library, keep a limited force constantly busy. A dictating machine with one transcriber has been installed, thus nearly trebling the output of one stenographer and affording a corresponding saving of money to the Commonwealth.

The vacancy caused by the resignation of Mr. Erwin H. Forbush, in 1913, as second clerk, was filled by the appointment in February of Mr. Robert Edwards Annin, Jr., of Richmond.

The bill providing for amending the present statute relating to the employment of clerical assistance in the office of the Board did not become a law, but the difficulty in which the Board would have been placed had no provision of funds been made was remedied by the ways and means committee's action in recommending an appropriation of $2,800 in addition to the $6,000 appropriated for dissemination. It is undesirable to have the clerks and stenographers paid from funds provided for lectures, publications and the library. It is recommended, therefore, that an annual appropriation of $5,000 be made in order that all clerks, excepting the first clerk, may be paid therefrom.

Extracts from the Trespass Laws.

Two lots of the cloth posters bearing extracts from the trespass laws have been printed, — one of 3,000, costing $145.19, and another, near the end of the year, of 500, costing $29.36. The authorization by the Legislature to sell, at not less than cost, copies in addition to the five allowed each applicant free of charge resulted in a total sale of 376 posters, netting $18.80. This money was turned into the treasury of the Commonwealth and credited to the Board's appropriation for incidental and contingent expenses, to which the cost of printing has been charged. The demand for these posters increased over the preceding year, and was greatest in the spring and fall.

Following the demand of poultrymen, a law was passed authorizing the detention by the owner of poultry, or by his agent or employee, of any one found in his poultry house without permission, and providing a severe penalty. In order that the protection thus afforded to keepers of poultry may be made well known, it is recommended that the secretary of the Board be enabled by legislative action to print and distribute such quantities of posters bearing the aforenamed act as may be required to meet the demand. The cost can be paid for out of the appropriation for incidental and contingent expenses.

Complaint from one source and another, of the nuisance committed by unauthorized persons in dumping rubbish on the property of others, leads to the recommendation that legislation be passed prohibiting such dumping and providing a penalty therefor.

It also seems desirable to amend existing law so as to prohibit the moving from one place to another on the land of another, without permission, such objects as are already protected from being cut down or carried away by those not authorized.

Legislation of 1914.

Out of fourteen recommendations for legislation only eight met with favorable consideration by the Legislature of 1914. The method of publishing the annual report was changed so as to provide for a more economical expenditure of the appropriation for this purpose. The annual report of the Massachusetts Agricultural Experiment Station was removed, as agreed to by the station, and the edition of the report reduced from 15,000 copies to not more than 10,000 copies, while authorization was given to print separates from the report in editions of not more than 10,000 copies each. The month in which societies shall receive their bounties was changed from October to August, in order that the money might be immediately available for use at the current fairs. An increase of $1,000 was allowed for use in premiums to children and youths for home and school garden work, domestic science and exhibits. The poultry premium bounty was restricted, and the payment thereof and the filing of returns regulated. The sale of the cloth posters, giving the extracts from the trespass laws, was authorized.

Five copies per year to each applicant are furnished free of charge as formerly, but those desiring more than this number may secure them at cost.

The salary of the State Ornithologist was increased from $1,500 to $2,000. An amendment was made to the wet lands reclamation act, so called, allowing owners to repurchase within two years reclaimed land at the original price plus the cost of reclamation plus interest at the rate of 4 per cent per annum. Permission was given to sell in the bale hay produced on reclaimed land. The powers of credit unions were extended so as to permit the lending of money to be applied to the purchase of farms and farm lands and to improvements thereof and thereupon. These unions were further authorized to issue nontaxable forty-year debenture bonds to an amount not exceeding 80 per cent of the total mortgage loans outstanding at the date of issue.

The following recommendations did not become law: a resolve providing for an appropriation of $2,500 to be used for collecting and distributing available facts relating to the agricultural resources, advantages and opportunities of the Commonwealth; a resolve providing an appropriation of $500 to be used in purchasing and caring for agricultural books, photographs, exhibits, specimens and the like for the library of the Board; an act providing an increase from $2,000 to $3,000 in the appropriation for the encouragement of agriculture by the holding of special exhibitions; an act to further extend and protect co-operative associations; and an act providing for a division of the appropriation for lectures before the Board and extra clerical assistance, so as to permit the payment for said lectures from the appropriation for disseminating useful information in agriculture, and so as further to permit the payment of all clerical assistance in the office of the Board, with the exception of the first clerk, from an appropriation of $5,000 for this purpose alone. While the last-named bill was not passed, a special appropriation of $2,800 was added to that for dissemination, so that the regular office force was maintained.

In connection, herewith, it is recommended that such laws enacted each year as relate to agriculture be published in the annual report of the Board, and separately at the discretion of the secretary.

MILK LEGISLATION.

Not less than thirteen bills relating to milk were introduced into the Legislature by various agencies. The only legislation placed on the statutes, however, was an act requiring producers and dealers to secure from local boards of health a permit to sell or deliver milk, and further requiring local boards of health to notify other boards of health and the State Board of Health of cases where a permit granted has been revoked. The power to enforce the latter provision was vested in the State Board of Health.

PUBLICATIONS.

The following publications were issued by this Board during 1913, and may be secured upon application to this office: —

NAME OF PUBLICATION.	Pages.	Number.
Agriculture of Massachusetts, 1913,	532	5,000
Bulletin No. 1 (fourth edition, revised),	160	3,500
Bulletin No. 2 (fourth edition, revised),	232	5,000
Bulletin No. 6 (first edition),	148	2,000
List of Available Publications,	8	5,000
Circular No. 3, Scale Insects,	12	2,000
Circular No. 4, Apple Packing,	20	1,000
Circular No. 8, Cost of Milk Production,	8	2,000
Circular No. 9, What it costs to produce Milk in New England,	12	2,000
Circular No. 11, Bacteriological Aspects of Milk Inspection,	12	2,500
Circular No. 12, Apple Diseases,	20	500
Circular No. 13, Clean Milk Contest,	16	2,000
Circular No. 14,[1] Currants,	8	5,000
Circular No. 15,[1] Cantaloupes,	16	5,000
Circular No. 16,[1] Grape Pruning,	12	5,000
Circular No. 17,[1] Poultry Feeds,	26	7,000
Circular No. 18,[1] Farm Water Supplies,	8	4,500
Circular No. 19,[1] The New Orchard,	16	8,000
Circular No. 20,[1] Farm Management,	24	10,000
Circular No. 21,[1] Dairy Cattle,	16	5,000
Circular No. 22, The Army Worm,	16	6,000
Circular No. 23,[1] Rural Credits,	20	6,000
Circular No. 24,[1] Alfalfa,	16	6,000

[1] Separate from sixty-first annual report.

Name of Publication.	Pages.	Number.
Circular No. 25,[1] Fertilizers,	8	5,000
Circular No. 26,[1] Nut Culture,	20	5,000
Circular No. 27,[1] Peach Growing,	12	3,500
Circular No. 28,[1] Co-operation,	8	3,500
Circular No. 29,[1] Farm Accounting,	16	3,500
Circular No. 30,[1] Farm Ice Houses,	12	4,500
Nature Leaflet, No. 6 (reprint),	4	2,000
Nature Leaflet No. 15 (reprint),	8	2,500
Nature Leaflet No. 16 (reprint),	8	1,500
Nature Leaflet No. 22 (reprint),	8	1,500
Nature Leaflet No. 23 (reprint),	8	1,500
Nature Leaflet No. 24 (reprint),	8	1,500
Nature Leaflet No. 25 (reprint),	8	1,500
Nature Leaflet No. 28 (reprint),	8	2,500
Nature Leaflet No. 36 (reprint),	8	1,500
Nature Leaflet No. 37 (reprint),	4	1,500
Nature Leaflet No. 44 (reprint),	8	2,000
Nature Leaflet No. 45 (reprint),	8	2,000
Nature Leaflet No. 46 (reprint),	8	2,000
Annual Report of State Inspector of Apiaries (Apiary Inspection Bulletin No. 7),	16	2,000
Apiary Inspection Bulletin No. 7A, Soft Candy Feed for Bees,	8	4,000
Apiary Inspection Bulletin No. 8, Honey Bees as Pollenizers,	12	3,500
Annual Report of State Nursery Inspector,	8	500
Annual Report of State Ornithologist,	32	3,000
Annual Report of Dairy Bureau,	28	1,000
Directory of Agricultural Organizations,	32	500
List of Breeders and Owners of Pure bred Cattle,	20	500
Seventy-one Farms for Sale,	12	1,500
List of Institute Speakers,	36	400
Directory of Milk Producers,	12	200

[1] Separate from sixty-first annual report.

The size of the volume, "Agriculture of Massachusetts," has been reduced by the omission of the report of the experiment station. The new method of printing the annual report, recommended in my report of last year, was put into effect with the last volume, and has resulted in a considerable saving to the State. The number of volumes was reduced from 15,000 to 5,000; and instead of the entire report being distributed to members of the Legislature and various agricultural organizations, they were given the right to order up to 25 copies each of the various separates from the report, which were issued as circulars. By this method of distribution people interested in some specific subject do not have to take the entire report in order to get the article which they wish. That this method has been popular with the general public is shown by the fact that a total of 47,652 copies of the various circulars from the last annual report were applied for by members of the Legislature and organizations. This does not include any of the individual applications for publications by letter and personal call. These have averaged about 20 a day. It must be remembered that the Board does not have the franking privilege and so keeps no general mailing list; our publications, therefore, go out only to those who show enough interest to actually apply for them.

Bulletins of Massachusetts Agriculture.

Three bulletins were published during the year. The fourth edition of No. 2, "Apple Growing," appeared in February, 1914. The extensive interest in this subject among our citizens is shown by the fact that out of an edition of 5,000 copies less than 200 remain at the present writing.

Bulletin No. 6, the new publication on "Dairying," which I mentioned in my last report as being in press, appeared in March, and this has met with a steady demand. It covers the various branches of the dairy business in Massachusetts in a comprehensive way. The fourth edition of No. 1, "Poultry Culture," was published during the summer. Prof. J. C. Graham's article, on "Poultry Feeds and Methods of Feeding," and Prof. James E. Rice's article, on "Some Practical Points in the Management of Poultry for Egg Production," were added to this bulletin, thus bringing it more nearly up to date. Out of an edition of 3,500 copies about 3,000 have been applied for. At present a new edition of Bulletin No. 4, "Small Fruits and Berries," is in press, and will appear in a few weeks. Bulletin No. 3, on "Grasses and Forage Crops," is ready to go to press; and would have been published last year but for lack of funds. With the funds now at our disposal for this work, not more than three or four of these bulletins can be published in a year; and with the present demand, this means that all of them cannot be kept in print at the same time. Bulletin No. 5, "Vegetable Growing," has now been out of print for over six months. It is hoped that this can be republished during the present year, as also a new bulletin, to be called No. 7, and which is to cover orchard fruits, with the exception of the apple.

LEGISLATIVE APPROPRIATIONS.

OBJECTS FOR WHICH APPROPRIATED.	1914.	
	Appropriation.	Used.
Traveling and necessary expenses of the Board,	$1,400 00	$1,498 79
Salaries of secretary and clerks,	5,700 00	5,700 00
Traveling and necessary expenses of the secretary,	500 00	384 90
Lectures before the Board and extra clerical assistance,	1,600 00	1,584 51
Incidental,	2,000 00	1,974 11
Dissemination of useful information in agriculture,	8,800 00	8,463 03
Printing 5,000 copies of "Agriculture in Massachusetts," and separata,	6,000 00	4,159 24
Bounties to agricultural societies,	30,000 00	30,000 99
Poultry premium bounties,	2,000 00	1,981 46
Encouragement of orcharding,	500 00	451 12
State apiary inspection,	2,000 00	1,996 47
State nursery inspection,	15,000 00	11,395 46
State Ornithologist, salary and expenses,	2,500 00	2,499 74
Special exhibitions,	2,000 00	2,000 04
Premiums to children,	2,000 00	1,855 35
Encouragement of dairying,	6,165 19[1]	5,379 28
Reclaiming wet lands,	25,000 00[2]	452 45
Dairy Bureau, salaries and expenses,	10,300 00	10,297 66
	$123,465 19	$92,074 60

[1] Total available.

[2] Jointly with the State Board of Health.

THE OUTLOOK FOR THE COMING YEAR.

Agriculture, in many branches, probably never had a more promising outlook than that for 1915. The war in Europe is bound to curtail production very heavily in all of the countries engaged, and it will therefore remain for this country to supply the enormous waste which this war has entailed. Crops of staple food supplies, which can be shipped long distances, should be grown as far as possible, such as grain, hay, onions, tobacco, apples, corn, and meats of all kinds.

Massachusetts can grow many of these crops, and is in a splendid position to ship them through the port of Boston. Many other crops could be preserved or canned, and steps should be taken to establish canneries in centers where such crops can be grown easily. The opportunity is yours, Massachusetts farmers. Will you make the most of it?

The production of many farm and garden seeds in our State should be carefully studied out, for while European countries have been producing much of our seed, there is no reason whatever why we should not begin to produce our own. It is generally true that seeds of the highest quality are retained by growers, and the person who buys has to take second choice. Therefore it behooves us to look into this matter thoroughly and see what can be done. The outlook for producing more meat in our State is promising, and will become more so just as soon as suitable slaughtering establishments are provided in local centers.

With wheat selling as at present around $1.40 per bushel, it would be well to consider the production of this crop on some of our lands. It certainly would pay better than some crops we are now growing, and we may look for a shortage in wheat for some years to come.

Fruit conditions are promising as undoubtedly the large apple crop of 1914 will not be repeated, and it is our turn to have a peach crop.

Certainly with Massachusetts importing three-quarters of the food supply, and with the great demand bound to be made upon us by foreign countries, the Massachusetts farmers may not legitimately complain of a lack of prospect.

Conclusion.

In closing this report I would like to express to you my cordial appreciation for the help given by all during the year. I sometimes feel that we do not get together often enough, and were it practical, I would like to suggest that the executive committee meet once a month. You are busy at your own vocations and no doubt cannot afford to come together so often, but if you have requests to make or ideas to advance, please do not hesitate to send them in. You are in close touch with your neighboring farmers and ought to know if we can help them, and it is largely through you that we may be of service.

Let us go out this year and preach the gospel of better farming for Massachusetts, better crops, better marketing, so that conditions in the rural districts will be such that a better citizenship may grow up in our State, founded upon the integrity and right living toward which life in the open country should lead.

Summary of Recommendations of the State Board of Agriculture.

1. That the annual salary of the General Agent of the Dairy Bureau be increased from $1,800 to $2,300.

2. That transportation companies, common carriers and other persons bringing broods of bees into the state be required to notify the State Inspector of Apiaries immediately of such shipments in order that, if deemed necessary, they may be inspected. Further, that the salary of the State Inspector of Apiaries be fixed at $500 per annum instead of $5 per diem, and that an increase from $2,000 to $3,000 be allowed for apiary inspection.

3. That the State Nursery Inspector and his deputies be authorized to inspect and, if necessary, to destroy, treat or return fruit brought into the state suspected of being infested with injurious insects or plant diseases liable to establish themselves in Massachusetts, and that an additional appropriation of $2,000 be provided for this purpose.

4. That cities and towns of 10,000 or more inhabitants be required to provide and maintain public markets for the disposal of farm produce.

5. That the trespass laws be amended so as to prohibit the moving, by unauthorized persons of certain objects resting on the land of another.

6. That there be established a Massachusetts land bank.

7. That the dumping of refuse or other material on the land of another without permission be prohibited, and providing a penalty therefor.

8. That the Board be authorized to print and distribute posters relative to poultry thieving.

9. That provision be made for the improvement of farm horses by the purchase and maintenance of thoroughbred registered stallions of draft or general farm breeds.

10. That the date of expiration of membership on the Board be changed from the second Wednesday in January to the first Tuesday in December.

11. That the Board be authorized to collect, tabulate and circulate information relating to the agricultural resources, advantages and opportunities of the commonwealth.

12. That there be provided a division of the appropriation for lectures before the board and extra clerical assistance, so as to permit the payment for said lectures from the appropriation for disseminating useful information in agriculture, and so as further to permit the payment of all clerical assistance in the office of the Board, with the exception of the first clerk, from an appropriation of $5,000 for this purpose alone.

13. That the packing, shipping and sale of apples be regulated.

Respectfully submitted,

WILFRID WHEELER,
Secretary.

PUBLIC WINTER MEETING

OF THE

BOARD OF AGRICULTURE

AT

WORCESTER.

December 1, 2 and 3, 1914.

PUBLIC WINTER MEETING OF THE BOARD, AT WORCESTER.

The annual public winter meeting of the Board for lectures and discussions was held at Horticultural Hall, Worcester, on Tuesday, Wednesday and Thursday, December 1, 2 and 3, 1914. The Worcester County Improvement League, the Massachusetts Dairymen's Association, the Massachusetts Milk Inspectors' Association and the New England Alfalfa Association also held their annual meetings at the same time and place, and the co-operation of these organizations helped the meeting both in attendance and interest. The total attendance at all the sessions was about 1,600.

The meeting was called to order on the first day at 10 A.M., by J. Lewis Ellsworth, president of the Worcester Chamber of Commerce and ex-secretary of the Board of Agriculture. Mr. Ellsworth introduced Honorable George M. Wright, mayor of Worcester, who delivered the address of welcome.

ADDRESS OF WELCOME, BY HONORABLE GEORGE M. WRIGHT, MAYOR OF WORCESTER.

I come here at considerable sacrifice this morning. This is my busy week, as you must all know who read the Worcester papers; we have a campaign here and election next Tuesday, and I am to play a more or less important part in the election. But I am very glad to be here and to meet so many of the men and women gathered here from different parts of the State at this convention. Mr. Ellsworth has referred to the fact that I am a Worcester County farmer. I have, it is true, owned a farm now for about five years, and have been going through the motions of farming and accomplishing some results. I am just completing a new modern barn 150 feet long, built of field stone, and with stone walls 18 inches thick — with the most modern system of ventilation installed, made on plans of my own. Every square foot of the floor space in that barn will see the sunlight, and the rays of the sun direct during some time every sunny day. That is a novelty which few cattle barns — that I have seen, anyway — possess. There will be something like seventy tie-ups of the most modern design, and there will be some other features about the place which are my own design and idea.

The city of Worcester is growing to be more and more a meeting place for organizations such as yours, and for conventions, whether agricultural or political or religious. They are meeting here almost every week. We have the State grange next week, and we have these conventions here continually. It is centrally located and we have now the best of hotel facilities and the best of railroad facilities, both electric and steam. And we welcome the members of any and all organizations throughout the State — and, in fact, throughout New England, because this is the center of New England — to Worcester to hold their conventions, and to meet here in our midst.

It gives me great pleasure, and I assure you it is a great honor, to bring to you here this morning the greetings of the city of Worcester, and a welcome and a godspeed in your future work in your chosen profession. I thank you.

RESPONSE FOR THE BOARD, BY WILFRID WHEELER.

On behalf of the members of the Board, in the absence of our first vice-president, Mr. Bursley, I will just say a few words in response to the Honorable George M. Wright's greeting to us in this beautiful city of Worcester.

It certainly gives me great pleasure to thank the mayor for his cordial greeting to us, and I am sure that we appreciate the chance to come to a city like Worcester, which is practically the center of New England, geographically speaking, and also one of the greatest agricultural centers in Massachusetts. Worcester is a city which is growing very rapidly, and we are glad to see its growth, and we are glad to believe that agriculture has had a great deal to do with the growth of this city. And one of the most hopeful signs of the times to me is to see the chief executives of cities, great business and manufacturing men, business men of all kinds, interested in agriculture as the mayor of Worcester is at the present time. Agriculture as a business, as a pleasure, is becoming more and more popular, and I believe that the mayor is setting an example in the right direction in building barns, in building up agriculture, and perhaps establishing an example for the farmers of this section which they may copy and go forward in a very honorable calling. And I thank the mayor very cordially for his greeting to us here to-day.

It gives me great pleasure at this time to introduce to you Mr. F. A. Russell, second vice-president of the Board, who will preside at this morning's session.

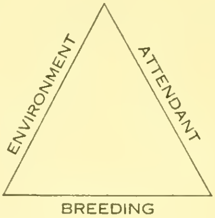
Mr. F. A. Russell. Mr. Secretary, Ladies and Gentlemen: It gives me great pleasure to be with you this morning; also it gives me pleasure to preside at one of the meetings of the Board of Agriculture. We have for the subject of our morning discussion a very interesting one — one which is taking a large place in the farming industries of the State, and one which, as we hear it talked about from the platform, seems to give the greatest profit, perhaps, of any farming industry there is, — as we hear it from the platform. We have with us this morning a gentleman from farther north than we are, and I am pleased to introduce Mr. W. R. Graham, professor of poultry husbandry, Ontario Agricultural College, Guelph, Ontario.

PROFITABLE FARM POULTRY WITH SPECIAL REFERENCE TO EGGS AND MEAT.

W. R. GRAHAM, PROFESSOR OF POULTRY HUSBANDRY, ONTARIO AGRICULTURAL COLLEGE, GUELPH, ONTARIO, CANADA.

Farmers in practically all countries of the world find the keeping of poultry profitable. It is true that some make much more money than others, which is also true of almost any branch of agriculture. Speaking generally, farmers grow better poultry than do those who try to grow a large number of chickens on a small area. My observations have been that most people succeed best, taking one year with another, who grow a variety of crops, rather than those who grow but one crop.

Let us now try and analyse the keeping of poultry on the farm. Permit me to present a diagram so that we may clearly understand our position.



We have here presented a triangle, all sides of which are equal, and my experience and observation leads me to believe that in order to succeed well it is necessary that equal attention be paid to each side, and, furthermore, neglect of any of these factors may be the primary cause of partial or complete failure.

The base or foundation represents breeding. Good blood is of prime importance. We all realize the importance of good breeding and constant selection in cattle, seeds, fruit trees, etc. Few, if any, expect heavy milk production or beef production from scrub cattle. Poor seed means a poor crop, and the planting of fruit trees of unknown varieties or seedling stock is not good business. The same is true of poultry just as much as in any other branch of farming. Good stock is the foundation. No matter how well fed and housed, nor how faithful and careful the attendant may be, the best success is not obtained without foundation stock of good breeding.

Study the kind of product your market demands, and then breed to please the buyer. I take it that you have here a good market for both meat and eggs. This means a discussion of the breeding of the dual-purpose hen, or what may be termed the American breeds in general. No doubt some of you may breed especially for egg production, and others breed largely for flesh production. The same general ideas, I think, will apply in all cases.

A study of European markets, and to some extent home markets, indicates that in the production of a high-class article *uniformity* is of prime importance. The *uniformity* of the goods shipped by Denmark makes a market for Danish produce. A farmer who has a reputation of producing a uniform good class of produce, whose produce is dependable, has less difficulty in selling, and ordinarily gets a premium price. He produces a uniform, dependable article. Uniformity in dressed poultry is not secured from scrub stock, and at times not from pure-bred stock; the same, in a measure, applies to size and color of eggs. In order to produce a uniform product it is necessary to study some of the underlying principles of breeding. With your permission I wish to show illustrations of some of the things that happen in breeding, also to discuss for a few moments some common practices in breeding. I am not a biologist, but I am interested in practical breeding, and therefore study as a common layman, and endeavor to try out in a practical way what science tells us. The art of poultry breeding is science applied. The first thing to do is to select pure-bred birds of the type or shape desired. If these cannot be found it may, in special instances, be desirable to cross breeds. In selecting breeding birds constitution or vigor is of first importance; it is the mainspring of the works, so to speak. Then we may select as to shape, size, egg production, color of skin and plumage, and if possible hatching power of eggs. Some of these characters are visible, others are masked or hidden, and the birds must be tried out. Select those that breed the best birds, regardless of relationship. Some say inbreed, others say do not inbreed. What is one to do? After trap-nesting and pedigreeing poultry for over ten years, and coupling with this some years of observation in breeding with small and large matings, I now am at the point where I would answer the above question by saying it depends upon circumstances.

Let us examine some of these ideas. Take, for example, the characteristic of size. If we cross a small breed with a large breed the resulting offspring in the first generation will be intermediate in size between the two, and are usually fairly, if not exceptionally, uniform in size. These crossbreeds may please us to such an extent that we decide to breed them together and perpetuate the kind; but here we encounter a difficulty, for in the second generation, or perhaps the third, if we rear, say, five hundred specimens, we find we have no uniformity either in weight, size, shape or anything else. We have about every conceivable thing that is known in chickendom, and, moreover, the mortality in birds bred as above is usually very high. We have lost that valuable desideratum — uniformity, though we may still have a few individuals of exceptional merit. This is the method to follow where you wish to secure something that you cannot already find in the existing breeds. As a common practice it is bad policy. Such results are probably the cause of the idea "do not inbreed." A similar result has come under my observation where two absolutely distinct lines of the same breed have been crossed and the progeny of such a mating bred together.

Now let us look at another side of this same method of breeding. If we take the few specimens that meet our ideal, and have plenty of constitution, and breed them together we find we begin to produce a uniform flock of a new kind. True, many may have to be discarded, but by close breeding we tend to fix the characteristics.

This does not yet answer the question as to what would be a good practice for the farmer.

The common practice of buying a new pure-bred male from a different breeder each season, where some care is taken as to general vigor and type, will generally give fairly good results as far as visible characteristics are concerned, because one is practically producing in a more or less degree the first cross. This plan must, in most instances, be continued.

Where one desires to make a product quite distinctive it will usually best be done by inbreeding the crossbred strains, watching for the divisions, selecting the individuals which meet the ideal and then inbreeding these.

The perfect specimen probably does not exist, hence, ordinarily speaking, one is forced occasionally to introduce new blood. This is best done by means of a new female, and then trying the offspring sparingly until such times as you get what you want.

Our pedigrees indicate that the male has much more to do with the pullets laying than does the female. It is, therefore, obvious that we should buy and select males from good laying hens that have been mated to good males, and I would consider it worthy of a trial to buy the new males annually from some *one* reliable breeder year after year so long as the resulting offspring is satisfactory.

Where eggs are wanted, especially during the first year of the hen's life, it is of importance to select birds, particularly males, which mature to nearly the desired weight at about five or six months. Closely associated with this, in our experience, is the question of early feathering over the back. Slow back feathering generally means slow maturing, which in turn is late laying. Our best layers usually begin laying at five, six or seven months of age.

The next side of the triangle refers to environment; that is, age of stock, housing, feeding and range. These conditions must be first class.

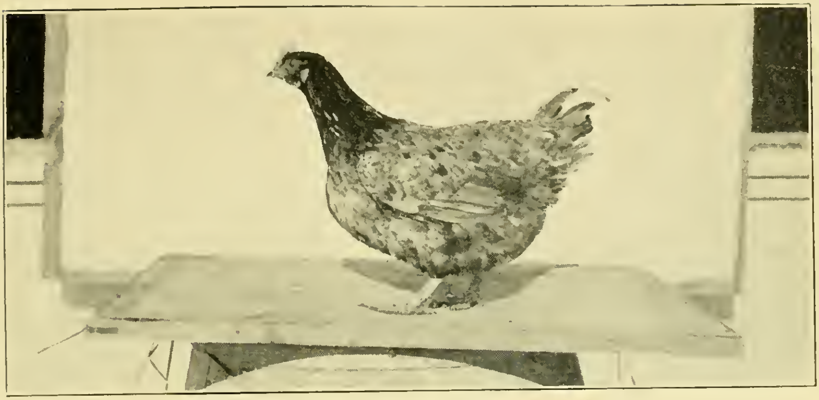
Late-hatched pullets seldom mature early enough to lay during the period of the high prices of eggs, neither do yearling hens commonly lay as well during the period of high prices as early hatched pullets, and hens two years old and over pay only as special breeders. Our records show, yearly, that birds that lay well during the winter are equally as good layers for the balance of the year as those who make little or no performance during the winter months.

Sizes, shapes and styles of houses are almost endless. This problem is ever present, and each one settles it to please his or her own conditions. It matters not so much the kind of house so long as abundance of fresh air is secured without direct drafts over the birds, and as long as the house is light and roomy. Dryness and reasonable cleanliness are also prime factors. The smaller the flock the larger proportionately should be the house, and, moreover, the labor cost per hen for caring for her is also increased. A man will take care of 15 one-hundred-bird flocks with less exertion than 70 ten-bird flocks. Your labor charges for care and management should be about 35 or 40 cents per hen per year. Keep your poultry houses well aired, dry and clean.

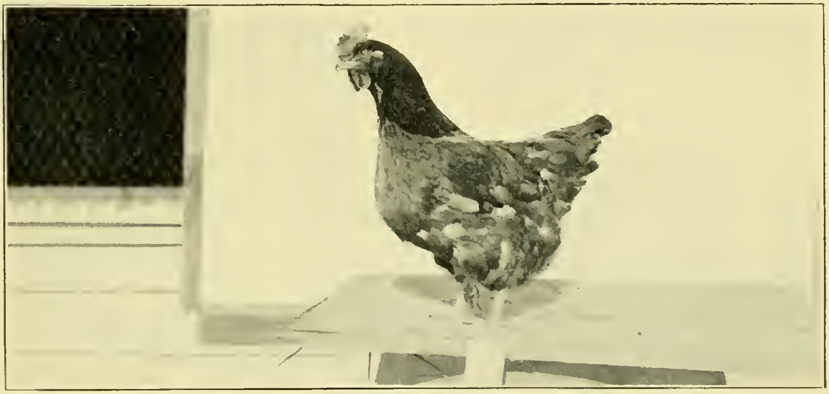
Feeds and methods of feeding are countless. Common sense appears to be an inactive factor in many human beings. Some try to mix and feed the most complicated grain mixtures possible. All these things take time and time costs money. I am not at all sure that a hard and fast rule for feeding can be laid down. The essentials can be enumerated and are as follows: green food, grain food, animal food, mineral food and exercise.

Green food ordinarily is cheap and handy, receives little attention, and hence I place it first to draw your attention. Poultry require considerable green food; it reduces the expensive feed bills and sustains health. In summer various grasses and waste garden truck supply the wants. Little chicks require very tender, crisp, green feed. For winter foods, clover, hay, roots, cabbage or sprouted oats will give good results. Feeding cooked roots is also a good means of cheapening the ration.

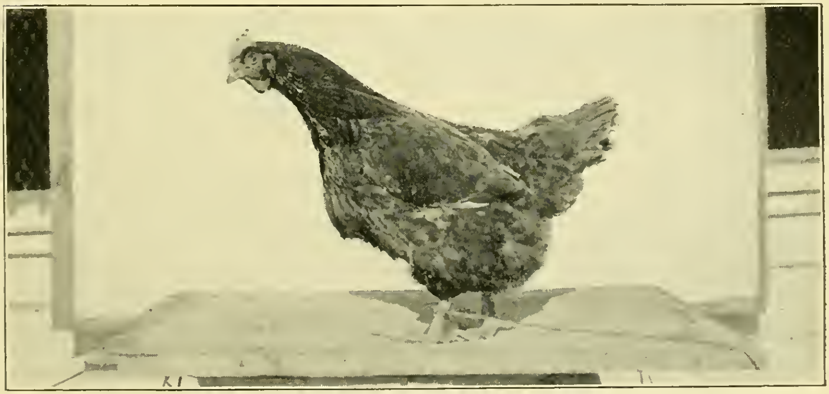
Experimental demonstrations with us show no great difference among these foods. Cabbage, if anything, encourages laying, while rape tends to color the yolks of eggs in some instances seriously, from a market standpoint. A full-grown hen will eat about 1½ cubic inches of sprouted oats per day. Ordinarily give the birds all they want, but do not feed decomposed or highly flavored feeds.



No. 400. Laid 208 eggs in ten months.



No. 523. Laid 50 eggs in twelve months.



No. 312. Laid 194 eggs in nine months and three days.

Three Hens from the Massachusetts Agricultural College Flock.

Wheat, corn and crushed oats are the staple grain feeds, and for animal foods nothing equals sour milk or buttermilk; when meat scrap has to be fed, about 10 per cent. of the mash food is all that may be given with safety. The birds would eat more and might do better for a short period of time, but a reaction is almost sure to follow. Mineral foods are supplied by granulated bone, granulated rock or grit, and oyster shell or old plaster.

It might be well to give you our method of feeding and then we might discuss the same. During the winter we use about equal parts of whole wheat and corn. This is fed in about 6 inches of litter early in the morning, say two handfuls for three birds. At noon the green food is given, and at night all the whole grain they will eat. We keep crushed oats in hoppers constantly before the birds. If the flocks gets lazy we close the hopper for part of the day to make them work. Sour milk is used as drink. Grit, oyster shell and granulated bone are always in little boxes where they can help themselves. When we cannot get sour milk and have to feed beef scrap I rather prefer mixing ground grain, such as middlings, corn meal, oat chop and 10 per cent meat meal, then feeding as a moist mash at midday. Sometimes we add to such a mixture about one-third in bulk of cooked roots.

The environmental factor of range is overlooked so frequently that I desire to call special attention to it. The following illustrations are two birds of the same breeding. The larger one is grown on free range where there are not more than fifty chickens per acre, and the smaller one in a small city lot where chickens are penned up. The case is extreme, yet at the same time is not uncommon.

Clean ground, tender green food, clean water and shade are essentials to growing chickens. Ground may be cleaned by crop rotation, which is undoubtedly the best plan, or it may be kept in fair condition by frequent plowing or digging. The proposition can be put in another form; that is, raise the young stock in the country, where there is an abundance of room and a variety of food, then you may bring them, when well grown, to the city, or the permanent long houses with limited runs. Old fowls can be maintained fairly well on old ground, but young stock rarely does well. This is the outstanding point in the farmer's case. He raises better chickens at less cost, owing to clean and pure surroundings.

Let us now consider the remaining side of the triangle. The attendant is worthy of serious consideration. My father told me that "one man's breath was good for stock and other men's breath was bad." This appears in a sense to be true. The attendant must develop a bond of sympathy between the birds and himself; in order to do a day's work he must move rather quickly but gently. Birds that are afraid of the attendant do not do their best. The attendant must consider his stock first and foremost and himself last. I believe in having a man dressed neatly but plainly. A poultry house is no place for blue clothes and white collars. A khaki suit shows little dirt and looks fairly neat. The attendant must be a keen observer, punctual as to hours, and have an abundance of common sense. Caring for live stock is no position for the careless, or the person who is looking for 6 o'clock.

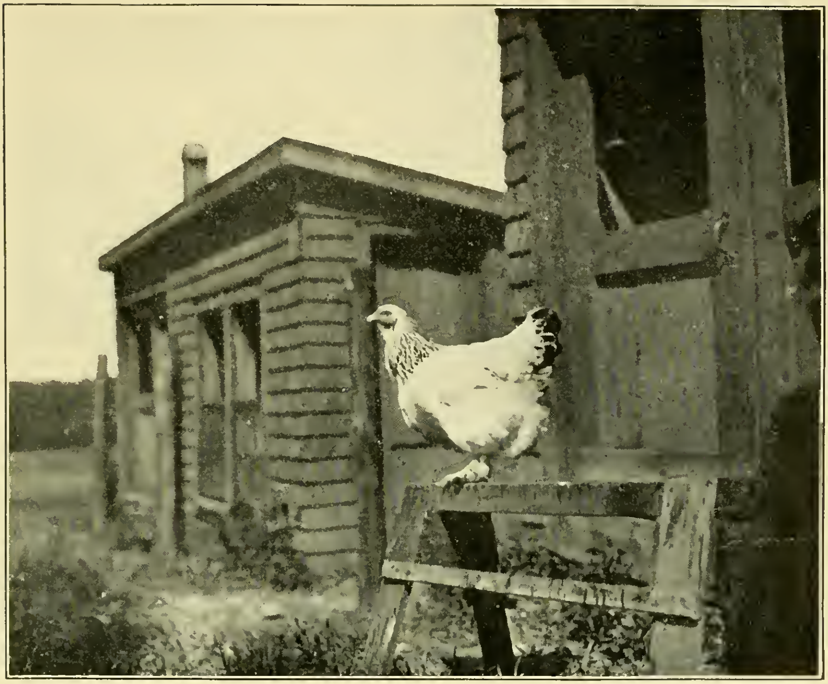
In conclusion I would suggest the attendant keeping in his hat the following words: "Fresh air and common sense." If these are there and he removes his hat occasionally he will not forget.

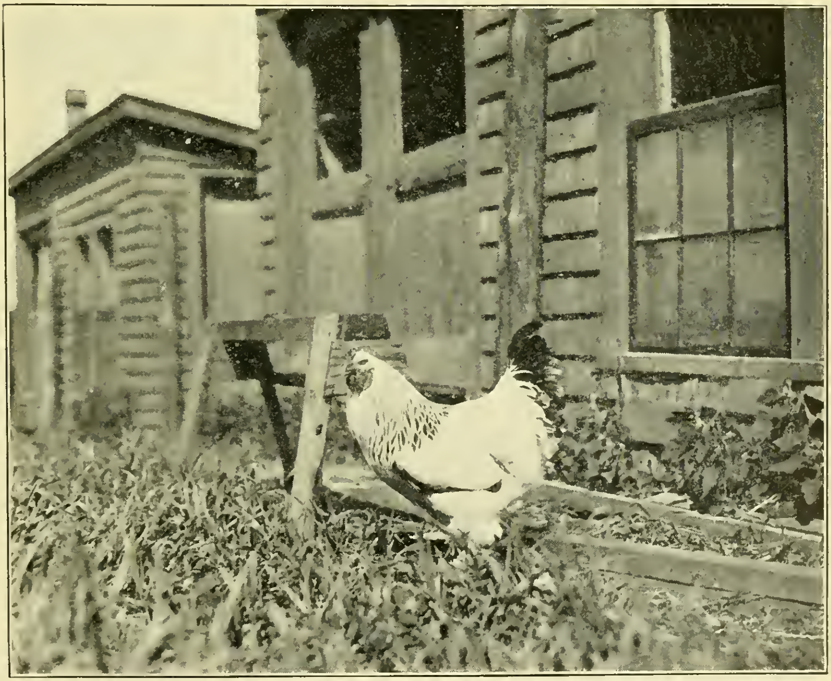
Mr. N. W. Sanborn. How about the weight of these high-laying females? Do you get as many pounds of eggs from the large egg-layers as from the moderate sized ones?

Professor Graham. Generally speaking, you will find more 200-egg hens which lay 23-ounce eggs than lay 25-ounce eggs to the dozen. We constantly have hens which will lay large eggs, — many of them. One of the hens we showed on the screen — No. 58 — laid 25-ounce eggs; but I will say that if you don't watch it you will produce little eggs.

Mr. W. H. Gould. Which do you consider the best flooring for a hen house, especially in the winter season, — earth or cement?

Professor Graham. Well, my experience in regard to the best flooring for hen houses is this: when you consider the cost of the litter and the cost of taking the ground out of the hen house every other year and renewing it, cement is the best





A pair of good utility fowls. Massachusetts Agricultural College.

floor. It takes more litter on a ground floor, and in a series of years, if you figure up the time and the cost of renewing the earth floor, it is better to have the cement floor. Now, where you use the cement floor, ordinarily you must supply some sort of a dust bag in one corner of the house. If you use only a little litter — say, two or three inches — then in a cold climate you get into trouble with the cement floor. In addition to that, never make the cement floor smooth or very rough. If you make it smooth the litter will blow all round the place; if you make it very rough the hens will wear their toenails down to the quick. The common finish, such as you have on sidewalks, is about the best that we know of. We have taken out practically all of our board floors and all our ground floors and are using almost entirely cement floors.

Mr. THOMAS D. GOVERN. Can you get as many eggs by feeding hard grain and dry mash as by feeding wet mash?

Professor GRAHAM. Where we use rolled oats we can, but I doubt it with other mixtures. The backbone of our egg production, in a word, depends on the rolled oats and the sour milk and the green food.

Mr. GOVERN. In Massachusetts, with milk at 42 cents a can, we can't very well afford to feed it to hens.

Professor GRAHAM. That is true. There is a difference in different sections of the country. With us sour milk is worth 20 cents a hundred. That is not very high. We buy oats at $28 a ton, $1.40 a hundred. But we can't get as many eggs out of beef scrap or cooked meat as we can out of sour milk. If you want to use beef scrap I would strongly advise your using a little bit of muriatic acid in the drinking water, for the reason that the hen's digestive tract is normally acid, and we frequently get into trouble when their digestive tracts become alkaline, and with sour milk, too, you get a value beyond the feeding value of the milk, largely due to its physical action, which maintains the normal sour or acid digestive tract. It has a value greater than its chemical composition shows.

Mr. C. F. WHITMAN. You dwelt considerably on feeding vegetables to poultry. Would you recommend feeding fruit, — apples or pears?

Professor GRAHAM. Yes. I would recommend the feeding of apples.

Mr. Whitman. Do you think it is good to feed vegetables?

Professor Graham. As long as they do not eat too many of the seeds, which is ordinarily not the case. At the present time we are mixing them in with roots. I would say in a general way that it is a good plan to give the hens any waste products that you have, like apples or turnips, but do not feed them on waste products exclusively.

Mr. Whitman. I asked that question because I want to know whether the cider pulp is better, or the apples and fruit itself before extraction.

Professor Graham. I will have to go back a number of years to give you my experience on cider pulp. During my first experiences in the chicken business I happened to be situated near a cider mill, and was able to secure cider pulp from the mill at low rate; and when I got that pulp fresh, when it had been ground the same day, and when I cooked it a little I got good results; but if I kept it on hand and it heated or turned a little sour the results were disastrous. Judging from this experience it would be necessary to feed it fresh.

Mr. J. M. Schwartz. In mentioning your green feed you don't say anything about alfalfa. How does that compare with cabbages?

Professor Graham. I have good results from good alfalfa, but in many instances with the alfalfa that we come in contact with, apparently they have taken the leaves off and used them for some other purpose. They sold us the woody stems as chicken feed, which has not given very good results. If you can get good alfalfa you will get very good results indeed. Personally, I would just as soon have the roots as I would alfalfa.

Mr. G. S. Dodge. How about feeding green ground bone?

Professor Graham. That depends on the kind of bone. If you are grinding the bones yourself by hand, I would say do not feed it, because you will get all of the knuckle bones which contain a very high percentage of fat, and are easy to cut. We have found in our experience that the machine-ground green cut bone, if fed with good judgment, will give good results. Where it is fed fairly liberally to the heavy breeds, such as

Plymouth Rocks or Wyandottes, it is apt to have some effect upon the hatching power of the eggs in the spring, and it is a food that has to be fed with discretion. I would say, in a nutshell, it is a good food for a man with an abundance of common sense to use, but it is a bad food if considered fool-proof.

Question. Is there any easy way to sour milk in the winter time?

Professor Graham. Yes, a very easy way is to put the sweet milk in a pail that has had sour milk in it and set it behind the kitchen stove over night and it will be sour before morning. One of the finest things about feeding sour milk is that you don't have to worry about everything being absolutely clean. If you are feeding sweet milk you must have everything clean. The easy way to get it sour is to use a barrel or large hogshead that holds from 30 to 100 gallons, and keep on pouring in and out.

Question. Do you feed the sour milk clear?

Professor Graham. Yes. As far as drink is concerned, when the thermometer goes below zero, all drinks are taken away and the chickens all eat snow. You will have less trouble with frozen combs and things of that kind if you feed snow.

Question. You do not think snow brings bowel complaint in any form whatever?

Professor Graham. No, I have never had that experience with it at all. We let them wallow around in the snow and eat it in cold weather. We dump the water out of the drinking tins and keep them filled with snow.

Mr. C. R. Harris. You mentioned the use of hydrochloric acid in the drinking water. Would anything else answer the same purpose?

Professor Graham. I am not in a position to answer that question. I have gotten my information along this line from our veterinary general of the dominion, and I asked him one day, "Is there any other acid that I could use or recommend in the place of this one?" He answered, "That is the only one that I have positive information on." So that is the best answer I can give you.

Mr. Harris. Is there anything other than judgment by which you can determine the amount and frequency of the use of hydrochloric acid?

Professor GRAHAM. From the available experience, for the quantity for general preventive work, about 1 teaspoonful of commercial acid to 2 gallons of drinking water. Either earthenware or wooden drinking articles should be used. You could not use the acid and metal very long or you would be in trouble.

Mr. BROWN. Would a flock of hens get sufficient drink through the winter from snow alone?

Professor GRAHAM. From our experience, yes, because we have numerous flocks of hens that are laying heavily in the winter time that don't get anything to drink except snow for weeks at a time. They may get some cooked vegetables or substances containing water, but, for example, in this open-front house I showed you we sometimes have a week at a stretch when the thermometer is between 10 and 29 below zero, and the thermometer inside the house showing from zero to 7 below. Now, you take an ordinary pail of water and set it down there and it is ice before you get out, almost. So there are weeks and weeks when they don't get anything but snow.

Professor BROOKS. I would like to ask the speaker whether he has ever had any complaints of the quality of eggs from feeding cabbages.

Professor GRAHAM. We have gone fairly thoroughly into the matter, and even from a high-class retail trade in eggs we have never had any complaints as to flavor, even when the hens had all the cabbages they could eat. I cannot say the same when the hens were fed rape, scorched or musty grains or onions, however, for these almost always affected the flavor unfavorably, and our customers noticed it.

Professor BROOKS. I don't want to occupy the time that belongs to the speaker, but I do wish to say that a number of years ago I compared two flocks of hens of similar breeding and similar housing in every respect, and fed similarly except as regards vegetable food. The eggs from the two lots were sent under numbers to a number of families, and the housekeepers were discriminating. There was never any failure to indicate that the eggs from the hens which were fed with the cabbage were superior to the others. They spoke of their sweetness and fine flavor; they did not recognize the cabbage.

They did not know what the feeding was. The two lots of eggs were simply sent with the request that they use them and advise if they found them different. There was always a report favorable to the cabbage. As to the analysis, they did not show a great difference but there was no taint in the eggs from the fowl fed with cabbages. Many of the housekeepers reported that they found that the flavor of the cabbage eggs was strong. They did not describe the cabbage flavor.

Professor Graham. I think what Professor Brooks says is absolutely correct. Now, I don't know whether you have in your locality here a trade for certified eggs such as there is for certified milk. I am under the impression that if that trade ever develops, the hens who lay those eggs will have to be kept indoors all the time. You will have to feed them right up on a diet arranged by a practical dietician, because there is no doubt that people who are not living an active life are mighty particular about the flavor of the eggs and the color of the yolk.

Mr. H. K. Proctor. I would like to ask about the fertility of hatching eggs.

Professor Graham. Do you mean fertility or hatching power?

Mr. Proctor. Well, hatching power. Which would be better, to put, say, four or five males with a flock, or alternate them one each day for five days and then repeat?

Professor Graham. I think from my experience the answer to that question would depend upon the range and the style of house in use. That is to say, if you had 5 males in the flock and 100 females there, or 75, and a house 20 feet square and the birds fastened inside, you would get better results to use the males a half day each, one in the morning and one in the afternoon, or one a day. But if the birds can get outside, or if the birds are in a long house in which there are partitions going three-quarters of the way across, then I doubt very much whether you would get actual results for the labor of cooping these males.

Mr. Proctor. Once in a while there is a cockerel who will give his head a little shake. He seems to be vigorous and all right in every way. I would like to know if that is a bad habit.

Professor GRAHAM. Well, I don't know, Mr. Proctor, whether that is a habit. It is sometimes one of the symptoms of worms. You could find out easily by going to your druggist and getting a worm powder, or take a piece of bread and put on turpentine and put it down his throat, or give him a chew of tobacco.

Professor BROOKS. About the rolled oats. Are those the oats from which the hulls have been separated?

Professor GRAHAM. The commonest kind of horse feed with us is the rolled or crushed oats, in which the whole oat is run through a roller and the oat comes out flat. Now, the men who handle horses in the largest number are farmers, and the farmers swear by rolled oats for horses. The way we started to feed them to the hens was, when ordering ground oats from a miller, he said he hadn't any on hand, but he sent us some rolled oats. The hens took so kindly to the proposition and liked it so much better than they did the chopped oats that I was perfectly satisfied. Now, they don't eat all the hull. As near as we can tell, they waste about 18 per cent of the hull.

Professor BROOKS. Would you blame them for wasting 100 per cent of the hull?

Professor GRAHAM. Yes, for this reason, which brings up a very interesting point: it seems to me that there are two sides to a feeding proposition, — a physiological side and a commercial side, and a certain amount of bran or alfalfa may obviate trouble in the stomach and give the juices of the stomach a better chance to act. We have tried the ordinary oats alongside of the common horse oats or crushed oats, and invariably we have gotten for a long period of time better results from the horse kind of oats than we did from the human kind of oats; but for a short period of time, say ten days or two weeks, if you want to fatten a chicken or get him ready for show, you can get there quicker with the aid of flour or rolled oats which you have for human food than you can with the crushed oats as fed to horses. But in the end we lose out in that we run into digestive troubles, particularly in the liver, we get a soft, pink liver. The average hen with us eats 72 pounds per year, — 24 pounds of corn, 24 pounds of wheat and 24 pounds of crushed oats.

Question. What do you consider the best feed for fattening chickens?

Professor Graham. Ours is a milk-feeding proposition. We teach our people to eat milk-fed chickens, and those are the chickens that bring highest prices. We use about two parts of finely ground oats or flour, or oats with the hulls partly sifted out, two parts of buckwheat and one of corn meal, mixed with sour milk. The vital factor is sour milk.

Mr. Robert Johnson. How about barley for feeding?

Professor Graham. It depends entirely upon the barley. If your barley is well ripened and is not musty I would be inclined to feed about two-thirds barley, but I would want to be absolutely certain that that barley was not musty and had not been scoured before I used it, because it is one of the grains about which it is difficult to tell whether it has been a little bit musty or not.

Mr. Higginson. How often do you feed cooked food?

Professor Graham. I don't suppose, ordinarily speaking, that we fed cooked feed twice a year, except from an experimental standpoint, until this year. Now we are feeding more cooked food than we ever did before, because grain is high and we have a host of mangels. It is a question of getting the mangels out of the way and cutting down the grain bill. But ordinarily we do not cook any feed. We sprout oats for them, or we give them cabbage and go ahead without any cooked feed. Just at the present moment labor is cheaper than feed. Ordinarily labor is dearer than feed, and when labor is dear and feed is cheap we will feed the feed and do away with the labor.

Afternoon Session.

The chairman for the afternoon session was Mr. Henry M. Howard of Newton, who introduced Professor T. C. Johnson of Norfolk, Virginia, to speak on "The Value of Experimental Work for Truck Farmers."

THE VALUE OF EXPERIMENTAL WORK FOR TRUCK FARMERS.

T. C. JOHNSON, DIRECTOR, VIRGINIA TRUCK EXPERIMENT STATION, NORFOLK, VIRGINIA.

The work of the experiment stations has long been recognized as of great value to the fruit growers, dairymen, stockmen and general farmers, but the truck farmers have not, as a rule, received their full share of attention. There are two apparent reasons for this. The nature of the crops grown is such that they occupy the ground a comparatively short period, and they are usually followed by other crops in quick succession. This renders it very difficult to conduct successfully a series of fertilizer or disease-control experiments. Such experiments on orchards and grain crops of which the plants occupy the ground for a number of years, or the rotations are definitely worked out, are comparatively easy, but with short-season truck crops the problem is quite different. The ability to shift from one crop to another tends to develop the idea of solving the problems, or rather dodging them, by changing the cropping system. This, of course, is not practical with the orchardist or grain farmers.

The experiment stations have not received the demands for assistance from truck farmers that they have from the other classes of farm workers. Accordingly, they have responded to these urgent calls, and of necessity neglected the interests of the truck farmers.

But within the past few years there has been a noted increase in experimental work intended to benefit the truck farmers. This is especially notable in the States of Virginia, New York and Illinois, and the United States Department of Agriculture has, through its Department of Horticulture, been conducting investigations on several phases of truck farming.

There are several classes of truck-farm problems which should receive attention from the experiment stations. The Virginia Truck Experiment Station was established for the purpose of solving some of these for Virginia market gardeners, as is set forth in section 2 of the charter as follows: —

> *Object.* — It shall be the object of the station to conduct researches on the physiology of plants and the diseases to which they are subject, with remedies for same. In like manner investigations looking to the control and eradication of insect pests shall be undertaken. The comparative advantage of rotative cropping, the capacity of new plants for acclimatization, the improvement of varieties through plant breeding and selection, and the utility of manures, natural or artificial, shall all be considered with such other researches bearing directly on the interests of the truck growers of the State as may be deemed advisable.

Vegetable growers in general are interested in the problems pertaining to soil fertility, soil utility and soil sanitation. Also, they are concerned with plant breeding, especially in its relation to the improvement of varieties and the development of disease-resistant strains in fungous and bacterial diseases and methods of controlling them; in insect studies, including life histories and methods of control; and in general marketing problems.

Soil Fertility.

The work on soil fertility should include such topics as the use of natural and artificial manures, the kinds to use on certain crops, the method and time of making applications, and the quantities best suited. All these important factors are influenced by the crop rotation followed. When leguminous crops are to be turned under for soil improvement, smaller quantities of manures may be used; but if a certain class of legumes are grown for market purposes, the soil may be actually robbed of a portion of its available plant food. In a series of experiments conducted by the Virginia Truck Experiment Station it was found that the yield of a kale crop was greatly influenced by the crop previously grown in the rotation, as recorded in Bulletin No. 9. The different plats in the experiment were cropped and treated as follows, and then planted with kale in August, 1912: —

Plat 1 was planted to beans in April of 1908, 1909, 1910, 1911 and 1912, with millet following the beans in July, 1908, 1909, 1910 and 1911.

Plat 2 was planted to potatoes in March, 1908, 1909, 1910 and 1911, and crimson clover sown after the potatoes were dug each year. The crimson clover was turned under for potatoes in the early spring of 1909, 1910 and 1911, and worked into the ground during the summer of 1912.

Plat 3 was treated in all respects similar to plat 2, except that an application of 1,500 pounds of hydrated lime per acre was given before planting the potatoes in 1908, 1909, 1910 and 1911.

Plat 4 was given an application of 15 tons of well-rotted stable manure per acre before plowing for the potatoes in 1908, 1909, 1910 and 1911, and for the corn in 1912. The potatoes were planted in March, and followed by corn in July of each year. In 1912 the potatoes were omitted from the rotation, and corn planted in May. The stable manure was applied immediately before planting the corn.

Plat 5 was treated in all respects similar to plat 4, except an application of 1,500 pounds of hydrated lime was given per acre after the manure was turned under, and before the potatoes were planted in 1908, 1909, 1910 and 1911.

All plats received equal amounts of commercial fertilizer during the entire experiment.

Plat 1 produced 6,829.71 pounds of kale per acre.
Plat 2 produced 8,919.71 pounds of kale per acre.
Plat 3 produced 13,824.00 pounds of kale per acre.
Plat 4 produced 13,834.28 pounds of kale per acre.
Plat 5 produced 16,893.91 pounds of kale per acre.

Using the yield on plat 1, from which both the beans and millet were harvested, as the basis of comparison, the use of crimson clover in the rotation increased the yield 30.16 per cent, crimson clover and lime 102.4 per cent, stable manure 102.5 per cent, and stable manure and lime 145.9 per cent.

The work on artificial manure should include a study of the source of the various ingredients used. For instance, in our work in Virginia we have found that the nitrogen for certain crops grown in the winter or early spring should be obtained from one set of combinations, while for the same crop grown in the later summer a different combination is desirable. The form of phosphoric acid to be used depends quite as much upon the condition of the soil as upon the crop which is to receive it. There is still much work to be done on the various sources of potash best suited for the different crops in any line of agriculture. Where large quantities of commercial fertilizers are used, there are almost certain to be deleterious results. The residual effect of fertilizer has so modified the soil constituents that it is now practically impossible to grow certain crops where they formerly thrived. It is often seen that large quantities may be used under one system of cultivation with good results, while under another the result might be injurious. Two crops might require a fertilizer of the same quantitative analysis, but quite different in the ingredients from which the materials are obtained. For instance, tobacco prefers the potash from sulphate of potash, while on certain soils peanuts yield better if treated with muriate of potash.

There is still much room for the study of lime for use in connection with truck crops. We know in a general way what the results of lime are, but the application and interpretation of these results in specific cases is sometimes quite difficult. The Rhode Island Experiment Station has added very greatly to our knowledge of the use of lime with many of our truck crops, but the results obtained on the Rhode Island soils do not necessarily apply in all particulars to other types of soils. Under some conditions pulverized limestone may give excellent results; under others the results from it are negative; but those from freshly burned lime are quite marked. The kind and quantity of lime that may be used in connection with commercial fertilizer and stable manure also vary with the character of the soil. The soils of the Norfolk sandy loam type in the southern Atlantic States are prone to acidity in reaction. Consequently larger quantities of lime may be beneficially used on them in growing such crops as potatoes, strawberries and beets, but on soils which are alkaline in reaction the results are often injurious. The influence of fertilizer on the acidity of the soil is still open for investigation. Some investigators claim that it is practically impossible to increase the acidity by the use of commercial fertilizer. However, experiments conducted at the Virginia Truck Experiment Station seem to indicate that the acidity may be markedly increased by the use of certain fertilizer combinations.

Drainage and Irrigation.

The acidity of the soil is also influenced very largely by the drainage. It is frequently said by good truck farmers that if they were forced to choose between drainage and commercial fertilizer they would probably select drainage as the more important factor in crop production. The amount of drainage and the location and depth of drainage pipes are best determined by the local conditions. Drainage experiments conducted on one type of soil under certain conditions throw some light on the treatment under similar conditions; but if the conditions are different, it is best to make the experiment on the particular soil in question. It is well recognized that drainage has a marked influence on the availability of plant food added in the form of natural or artificial manures, but it is not so well known under just what conditions the plant may get the maximum quantity of these ingredients with the minimum loss by leaching. The effect of drainage on the relative earliness of market garden crops is obvious.

Irrigation should be studied in connection with drainage. It has been the general opinion that our irrigation problems were limited to the arid and semi-arid districts of the west, but we are now fast realizing the importance of an abundant and constant water supply for our eastern agriculture. The intensive truck farmer in the upper south would no sooner think of attempting to grow his crop without adequate drainage and irrigation facilities than without the use of stable manure or commercial fertilizer. The time, the quantity and the method of application are still fruitful subjects of investigation. We know that in a general way most of our truck crops should receive at least an inch of water per week, but there are some that will thrive better with one and one-half inches or even two inches, provided the drainage facilities are adequate. The ditch or furrow method of applying water has long been the standard in many sections of the country, but a few years ago the overhead system became quite popular. Now there seems to be a trend toward the furrow method under certain trucking conditions in the far south and the semi-arid west. There seems to be no definite data on these points which will enable the farmer to learn just which method he should use under his conditions. There is room here for a large amount of work.

Plant Breeding.

The work of the plant breeder in modern agriculture is almost as important as is that of the soil physicist. To the plant breeder we are indebted for the numerous adaptations of vegetables which have brought large remuneration to certain localities. For example, if only one kind of potato could be grown, many districts giving large acreage to that crop would be deprived of that industry.

Since there is great diversity of soil, climate and market conditions in the country, there arises great necessity for the development of characteristics adapted to use in the given surroundings. Accordingly, the plant breeder is devoting himself to this line of work and has produced some well-known results. The soil, climatic and cultural conditions in eastern Virginia require a class of spinach of the Savoy type, while under conditions prevailing in Louisiana the Savoy does not thrive so well as some of the thick-set or long-standing types. Market growers in the vicinity of Grand Rapids use the open-head or loose-leaf lettuce, while those in the Atlantic States grow some form of head lettuce. The plant breeders are at present busy making still further developments of these strains which have been adapted thus far to local conditions. Until a few years ago it was thought that tomato seed obtained from a typical individual of a variety would give the best results possible, but now it is known that in addition to being from a typical plant it is best to pollinate the flowers with pollen from another plant of the same variety, thus infusing new blood into the combination. By specialized breeding the cucumber has been adapted to the cultural method of the open field, the cold frame and the greenhouse.

The truck farmers in the south have long since learned that the potatoes of the Bliss type may be grown in Florida, Texas and Louisiana with a profit, but that in the Carolinas and Virginia the Cobbler type is more popular, and in Long Island other types come nearer meeting the requirements. The early Ohio is popular in the middle western States, but in the south Atlantic it is held in poor esteem. Thus it appears that potato growers in the best producing centers have learned to depend on certain varieties of seed adapted to their special interests. After securing a variety desirable for a given locality, the plant breeder has open before him a large opportunity for developing strains resistant to disease and unfavorable environment. The Crosby Egyptian beets, now used to a large extent in Massachusetts, are favorites with the Virginia truckers for their early spring crop, but the Egyptian beets are preferred for the late summer and fall crops.

The laws governing the transmission of characteristics in breeding are fruitful sources of study. The work done in this line by a number of the experiment stations in both American and European countries is fast becoming of great value to truck farmers.

Plant Diseases.

The experiment stations have devoted a great deal of time and energy in the last twenty years to studying the causes of plant diseases and the remedies for them, yet in some lines of agriculture this work has hardly started. The study should now be devoted to discovering the causes underlying the diseases of plants. In some trucking sections the excessive use of commercial fertilizer, together with the intensive methods of cultivation, have rendered conditions favorable for the development of certain classes of diseases that otherwise would not be likely to occur. The study of the exact conditions making it possible for the disease to develop should be undertaken. After this discovery the application of remedies may be much simplified.

The life history of the organism causing certain diseases should receive careful study. It is important to know the life cycle of the organism in order to combat the specific disease. If the market gardener wishes to maintain the health of his plants, it is as important for him to keep his plantation in a sanitary condition as for him to treat the diseases after they make their appearance. But in order that he may do this intelligently, the scientist should be in a position to give him the full life history of the organism causing the trouble. He should know where the organism spends its time when not on the plant in question. It frequently happens that diseases may be introduced into new localities on the seed. A marked case of this kind was encountered in eastern Virginia in the spring of 1911. A large grower of plants purchased cabbage seed from a certain seed concern and planted them for the purpose of growing plants for his neighbors. He supplied about two million plants to the different truckers. Within a few weeks ploma wilt appeared in all the fields where plants from this particular lot were used, the loss resulting in from 50 per cent to 90 per cent of the crop. The man who grew the plants was guilty of negligence, and the man who used them was innocent; but if the plant grower had followed the instruction given by the experiment station, the disease need not have been introduced.

Some diseases may be controlled by soil treatments. That is, the soil may be rendered favorable or unfavorable for their development by the treatment given it. This is especially true with some forms of bacterial and fungous diseases. In other instances, the disease may be controlled by treating the seeds or the vegetative portion of the plants used for propagation.

The Virginia Truck Experiment Station in co-operation with the Maine Experiment Station has been conducting a series of investigations looking to the control and eradication of the "black-leg" disease formerly prevalent in some potatoes brought from the north and planted in the south. This work has resulted in developing practical means of eliminating the trouble by selection of the seed potatoes in the fields in the north.

At the present time the preventive measures are much more important than are the curative. Blight can be controlled in the potatoes by spraying with fungicides before the disease makes its appearance, but if once established in the plants, the problem of eradicating it is quite difficult.

The experiment stations frequently outline modifications in methods of culture that will largely control a number of the more malignant diseases.

Truck Crop Insects.

It has long been known that such insects as the Colorado potato beetle and the codling moth can be controlled by the application of arsenical poisons, but with aphides and numerous other insects it is important to know their life histories in order to combat them successfully. The truck farmer can apply the remedies, but the investigator should work out the life histories in order to know when best to make the application. Recent studies conducted at the Virginia Truck Experiment Station show that the pea aphis spends a great deal of its time while not on peas on clovers and similar plants which are green throughout the mild winters. Consequently, a large number of insects are in waiting when the peas make their appearance in the early spring. A knowledge of this fact serves to caution the trucker not to grow peas and clover in close proximity.

The feeding and migratory habits of the insect should be studied carefully. The larvæ of the fig beetle in the south has the obnoxious habit of feeding on organic matter contained in very rich, sandy soils. Their burrows in the soil are sometimes so numerous that such a crop as parsley may be practically ruined. The insects have the habit of coming to the surface of the ground at night and crawling from place to place. A knowledge of this habit enables the truck farmer to trap them in open ditches.

By the omission of crops in rotation which furnish hibernating places, or by the intelligent disposition of the refuse left after harvesting, the injury from other classes of insects may be greatly reduced.

Marketing Problems.

The various phases of harvesting and marketing are fruitful fields for investigation. Refrigeration in transit and pre-cooling for long shipments are receiving the attention of the fruit growers, but very few experimental shipments of vegetables have been undertaken. This question is interstate in its character. Consequently, it should be undertaken by the Federal Department of Agriculture, or by different experiment stations as a co-operative project.

Systems of cost accounting are receiving careful attention by the various farm management departments, but the questions involved in proper marketing of garden products are receiving but little consideration. The matter of distribution is of much importance. It frequently happens that vegetables will be selling very low in one neighborhood and high in another only a few miles distant on account of the poor methods of distribution. This feature should receive attention by the departments of agricultural economics.

Mr. H. F. Arnold. I wonder if it would be out of place for Professor Johnson to tell us what the trouble was that he spoke of with those cabbages, and what the remedy was that he applied to that trouble.

Professor Johnson. It was a form of wilt which was overcome by treating the seed with a formaldehyde solution. Treatment in that way would have effectively prevented that. It was a disease that was brought in with the seed. The Ohio Experiment Station and Federal Department of Agriculture both published bulletins on that proposition.

Question. I would like to ask the professor if he has found, in his experience, any difference in the keeping qualities of vegetables raised by irrigation.

Professor Johnson. Not in my personal experience. In the west the farmers claim to have produced a better grade of vegetables by irrigation, but they have a tendency to be a little softer. But the quantity and the grade are so much better that they counteract any negative results.

Mr. Howard. In regard to that disease in potatoes, how did that affect the potatoes?

Professor Johnson. The disease makes its appearance on the young potato plant when it is 6 to 12 or 15 inches tall. It causes a blackening of the stem first, which runs down to the tuber, the stem topples over and the tuber rots. This disease has the fortunate habit of not carrying over in the soil, so that it is a very easy disease to control.

Mr. Lewis. I would like to ask the speaker if he can give us any information on the melon blight or cucumber wilt.

Professor Johnson. There are two or three of those blights.

Now, we have in the far south a bacterial wilt which I don't believe you have in this State. Then we have some of those fungous diseases which cause trouble. With the bacterial wilt it is a question of proper rotation to get that out of the soil. Of course, in the bacterial wilt we have to go a step further and not reinfest the field by using manure composed of the decayed vegetables that have had this bacterial wilt. In a lot of our work we have done spraying on cucumbers and have used the Bordeaux mixture. If we can get one composed of a small amount of copper sulphate and a small amount of lime, and have a good pressure, we can get good results. If we use a 5-5-50 Bordeaux and apply with a low pressure pump our results are sure to be negative. But where we use a 6-6-50 Bordeaux and apply it under 100 or 125 pounds' pressure, and arrange the nozzles of the pump so that we can get under the inside of the foliage, we have been able to hold up the cucumbers for weeks.

Mr. H. F. Tompson. I would like to ask Professor Johnson about the apparatus that is used for applying the Bordeaux mixture.

Professor Johnson. We have not been able to buy a satisfactory machine on the market for that purpose. There are several types of spraying machines that are used, any of which give good high pressure, but they are usually two-gear machines, geared to wheels. We use them so as to have three nozzles play on a row of cucumbers, two nozzles set so as to play in at an angle, and a third one to play on the top of the row. And we arrange those so as to spray two rows of cucumbers each time the machine goes across the field. Some of our farmers have spray pumps that will hold up a hundred pounds of pressure under nine nozzles, — these large type of nozzles. Where they use nine nozzles it usually takes about 125 gallons of liquid to spray an acre of ground, and we have to have spray pumps that will sustain 125 pounds' pressure.

Question. How early is that spraying done?

Professor Johnson. The spraying is usually started when the vines are 16 or 20 to 24 inches long. I don't like to wait after 24 inches, and don't start before 16. The spraying has a slight tendency to delay the first setting of the cucumbers, that is, it keeps the vines green and vigorous. In this spraying we usually find it advisable to train the vines on the rows so that we will get through the vines.

Question. I would like to ask the speaker if he thinks melon blight is caused by weather conditions or insects.

Professor Johnson. Neither one. The weather conditions may be favorable for the development of it, but the melon blight is either a fungous or bacterial disease. The insect comes in when you have a bacterial disease, and the insect sucks the juice out of the plant, and it may be carried out to other plants. The insect may be either of the flea-beetle type or the striped cucumber type or another type the name of which escapes me for the moment. The control of insects plays a large part in the control of the distribution of plant diseases, the insect getting the plant diseases on its body and carrying them to other plants. We have had all that demonstrated recently by the typhoid germ being carried by the fly.

Mr. Higgenbotham. What is it that attacks the small plants just as the seed leaves are coming out? On the cucumber the leaves seem to curl up and turn yellow.

Professor Johnson. There is a small beetle that looks something like the flea beetle. It is not the flea beetle, but from ordinary appearance it might be taken for one. Those insects jump off and go on the ground. Now, one of the best remedies we have found for them — not a remedy, after all, but only a means of driving them away — is by applying raw fish scrap, — dried ground fish scrap. Do not take fish scrap that has been treated with phosphoric acid, but take the ordinary fish scrap. You can put that right on top of the cucumber plant as it comes through the ground and it will drive them away. It does not kill them.

Mr. George W. Trull. Did I understand you to say how many times you spray for blight?

Professor Johnson. We usually spray cucumbers about every ten days or two weeks, depending on weather conditions, making the first application when the vines are 16 to 20 inches long. If we have dry weather it is not necessary to spray more than every two weeks, but if the weather happens to be a little cloudy or with some rain, and the vines are making a rapid growth, we prefer to make the sprayings not over ten days apart, and to make four or five sprayings a season.

Mr. Howard. I would like to ask Professor Johnson what support he has received from the truck farmers? How do they take to these experiments?

Professor Johnson. Our truck farmers in eastern Virginia, to use a slang expression, decided some eight or nine years ago that they were up against a hard proposition, so to show their faith in the work they got together and bought a farm and then went down in their pockets. In addition to buying that farm, they paid out $7,500 in cash for buildings on the farm, and then they turned around and leased that to the State for ten years without rent and renewable at the option of the State. In other words, they turned it over to the State and asked the State to come in and run that work. The State took up the proposition and has made the appropriations and has continued the work. Now, every time that our experiment station wants anything from our Legislature the first thing we do is to go to the truck farmers and get a good committee from them, and then we go to the Legislature and we usually get some money. The value of that property that the truck farmers have put into the work is to-day $25,000; that is, if the State should vacate the property the farmers could sell out for $25,000 or $30,000, but they are perfectly willing to let it go on, and in addition make frequent contributions for certain improvements or investments.

Question. I would like to ask, what are the features of the organization?

Professor Johnson. There are two organizations in eastern Virginia that are back of it. The one that fathered the movement was the Southern Produce Company. It is a co-operative trucking organization at Norfolk. The other organization is the Eastern Shore of Virginia Produce Exchange. As I understand it, the Southern Produce Company did not ask the Eastern Shore Produce Exchange to help at the time the project was started, but after that the Eastern Shore Produce Exchange came in, so that those two organizations are behind the work, and the work is supported by them. The Southern Produce Company is an organization in eastern Virginia of 400 members, and it does $2,500,000 worth of business. The other is an organization of about 1,500 members, and their secretary and treasurer told me the other day that their business for this year amounted to a little over $5,500,000. I might say in that connection that practically every State that has taken up this work has taken it up with the hearty co-operation of the people who are interested in it. Market growers or vegetable growers or truck farmers, — by whatever name you call them — must get behind the proposition to make the proposition fairly successful if they want to get the benefit of it.

Mr. Howard. Professor Johnson spoke about malnutrition in regard to raising a spinach crop. I would state here that we have had a good deal of trouble with the spinach yellowing at times in the fall, and at times in the midsummer. Can you give us any information on that?

Professor Johnson. That is one of the troubles we are working on now, and have been working on for the last two or three years. That yellowing of the plant is one of the hardest propositions we have had to meet in our spinach troubles. We have done this: wherever we have used the wide rotation and used a good deal of lime we have not had much trouble; where we have used close rotation and neglected to use the lime we have had a good deal of trouble.

Question. Do you have mold on the spinach?

Professor Johnson. We have done some work on spraying spinach when it was young, but of course you understand there would be objection to spraying spinach with Bordeaux mixture. Mold has not proven very detrimental to us yet. We have it in some of our fields. It is largely a question of cleaning the fields and preventing the introduction of the disease from other fields or from other sources where the disease may be spending some of its time. There is a question again of plantation sanitation, as we might put it.

Mr. Howard. I think there are a number of truck farmers here, and market gardeners around Worcester and Boston who are present at this meeting. We certainly have troubles enough in regard to producing good crops. One of our big problems has been the looking after sanitation in the soil, — to keep the rubbish out of it. I would like to get Mr. Hittinger to say a few words in regard to what he has accomplished in that line.

Mr. Hittinger. I don't just understand what you mean. In the greenhouse or out of doors?

Mr. Howard. In regard to the greenhouse work, because you have got rid of so much of the lettuce rot.

Mr. Hittinger. That is done by keeping the ground cleaned up; keeping the old stuff out of the soil there; not putting it into the manure. I will state what we do to the old refuse that is left from our outdoor crops. I generally clean it up and form it into a pile and make a compost heap out of it; take some coal ashes and then mix it in and put manure with it, and put it on some of our lighter soils, and it seems to work all right there. I notice when you leave it in the soil there you are apt to have more trouble. In the greenhouses we generally keep that stuff all cleaned up. Now, we have never sterilized in our greenhouses, and by doing that we avoid sterilizing any houses. I would like to ask one thing: if you don't find that yellow comes after you manure a piece of ground in the fall, then why do you plant spinach where it has never been manured?

Professor Johnson. We have been able to control that best on our soil where we have plowed under a crop of cow peas. We find that trouble has not been caused by the application of manure; in fact, we have been able to control it largely by the application of manure, that is, we have added to the vigor of the plant so much that it has been able to withstand those troubles.

Mr. Arnold. I would like to start a little bit of discussion here, — in fact, to get the opinion of some of you other people about that question which has been brought up about the refuse crop. We have had a little discussion at home between myself and my brothers on the subject. On a trip recently to the market gardeners we stopped at Long Island on the farm of Mr. VanSuclin there, and I noticed he spoke of being very careful to clean up the refuse of all crops, — carrot tops, beet tops, anything of that kind, — to clean them off the land. It has always been our practice at home to plow in that kind of stuff. What do you do with celery trimmings? We take ours out and plow them into the land; we believed there must be some value in them. As far as the question of disease is concerned, will the disease of the celery carry over the winter in the land that is outdoors? I would like to get some opinions on this question. It seems to me the best we can do with that stuff is to plow it in. We pay money for refuse straw that has been used as litter under a horse, and I can't see any difference in that and good healthy celery, or with some few spots on it, carrot tops or beet tops, or anything of that kind.

Mr. TRULL. I was in Lawrence only a short time ago, and a druggist said to me, "What are you farmers all buying so much formaldehyde for?" I said, "I don't know; is that a fact?" "Yes," he said. I told him what I wanted of it. Now, can you tell me how we should use it and what it is good for?

Professor JOHNSON. Formaldehyde is used for several things by the farmer. It is especially used in treating potatoes that have scab for the prevention of the spread of the scab in potatoes another year. It is also used by the farmers of the west in treating wheat for smut. It is used in treating a number of seeds to cleanse them of germs of disease that may be carried over on the seed.

QUESTION. Tell us, please, how you treat them.

Professor JOHNSON. In treating wheat we usually make a solution of 1 pint of formaldehyde to 30 gallons of water, and then spread the wheat down on a canvas and spread it out so that it is a few inches thick, and moisten it with this solution, — the water and the formaldehyde solution, — and allow it to stand a little while before the wheat is sown. In treating potatoes we make a solution of 1 pint of formaldehyde to 30 gallons of water, and dip the potatoes into that solution for two hours, take them out, allow them to drain and dry, and then go out and plant them.

QUESTION. Will you tell us what kind of formaldehyde to ask for when you go to the store to buy it? In one case I sent a man to a store to get it and he got something else.

Professor JOHNSON. We use 40 per cent commercial. What is the price of it here? I know what we pay for it in hundred-pound carboys.

A VOICE. About 20 or 25 cents a pound. They charge 75 cents for a pound of chemically pure.

Professor JOHNSON. A person ought to buy the material in large quantities — 100 or 200 pound lots — at 9 to 12 cents a pound. A pound is a little less than a pint.

Mr. Howard. I would like to ask Professor Johnson what he requires of these farmers in cleanliness in regard to diseased crops. When they have diseased crops, does he allow them to plow the latter into the ground, or does he recommend them to clean up the land?

Mr. Johnson. Most of the farmers follow the practice of cleaning up. Most of them, if they have any disease appear in the lettuce, will remove not only the head of lettuce but the soil around the head. This is especially true when the lettuce has lettuce droop. The head will be removed and burned in the furnace, or taken away where it will not get back into the soil. The question came just now about leaving the lettuce on the ground. There is another problem comes in which is rather important to the southern grower, that is, in growing our spinach we will harvest it in November to March or April. Now, if we harvest a crop of spinach in March and expect to follow that crop of spinach with snap beans we are going to have trouble on our hands right off and our trouble comes in a way you would hardly expect. There is a little black fly that deposits eggs on the refuse spinach that is left on the ground. If we turn them into the ground we will have the finest crop of root maggots you ever saw. Those flies deposit their eggs on the leaf, and the decaying leaf goes into the ground. It practically insures your not getting the beans. If we turn that spinach under and leave it under for thirty to forty-five days before we plant the beans we are not troubled. Further, we have found in our work that if we plow under a diseased crop of cucumbers we are almost sure, — if we follow immediately with cucumbers, or within twelve months, — we are almost sure to have the disease worse in our cucumbers than if we had not plowed under the disease at the time. So that I would emphasize that. The question of sanitation is really a very important question in the control of our market-garden diseases.

Mr. Brown. That question is one that has interested me a good deal. I was present in a market gardener's meeting recently, and one man said to me that if he had his way he would clean up his celery fields absolutely, if it wouldn't cost him much money. In my own case this last year I planted celery on a tract of land where I had blight last year, and again this year. A friend of mine who was in the business in 1913 had bad blight in his celery, and in 1914 planted the land with celery and had the best crop he had ever raised. I can't explain it and I don't believe you can. I can't tell whether that blight is carried over in the soil or not. In my experience I should say it was perfectly positive it was so; but I go to my friend who did the same that I did and he had not a bit of trouble.

Evening Session.

Mr. John Bursley of Barnstable, first vice-president of the Board, presided at the evening meeting and introduced Mr. W. H. Woodworth of Berwick, Nova Scotia, who spoke on "Co-operation in Fruit Growing as Practiced in Nova Scotia."

CO-OPERATION IN FRUIT GROWING AS PRACTICED IN NOVA SCOTIA.

W. H. WOODWORTH, BERWICK, NOVA SCOTIA.

It is constantly remarked, and perhaps with a certain amount of truth, that farmers, as a class, are so set in their ideas that it is impossible for a body of them to work together to accomplish any particular purpose.

This co-operative movement, of which I am to speak to you, was organized in 1907 by a few of the best fruit growers in Berwick, a pretty village in the heart of the fruitful Annapolis valley in Nova Scotia. The method of handling the fruit products of the valley prior to this date was very easy and eminently satisfactory to a certain few individuals, but far too easy and satisfactory to be much appreciated by the fruit growers.

The European commission houses handling Nova Scotian fruit had their agents over here. During the shipping season these agents had subagents at nearly all railway stations from which any quantity of fruit was shipped. On an appointed day the farmer would pack his apples at home and haul them to the station, where the subagent would make up carload lots and forward on his immediate superior's orders. These apples were then left to the tender mercies of the consignees, who, when they eventually sold them, would commence piling up an account of charges that were really startling in their ingenuity. A charge was made for every conceivable thing under the sun, including commission for every one who had anything to do with the apples, and when all was deducted that the consignee's conscience would allow, the farmer received an account of sales and sometimes a check representing what remnant of the wreck remained for him. The farmers chafed under this system of disposing of their products, but individually could do nothing.

An attempt was made about ten years ago to organize some kind of a co-operative movement, but owing to the fact that it was on too comprehensive a scale and was not founded on business principles, it was a failure.

In 1907 a few of the most up-to-date and energetic farmers in Berwick made up their minds, however, that in co-operation alone was to be found a cure for the state of affairs that then existed. The product from their orchards was increasing year by year, and they realized that there were only two ways in which they could give proper attention to the packing and grading of their fruit. One way was to build individual apple houses on their farms large enough to permit of fruit being stored and packed; another way was to get together and build or buy a large warehouse on the line of railway, where the apples of all could be stored and packed. The latter was the scheme that appeared the most attractive, and these men formed the first co-operative fruit company in Nova Scotia.

This company was called the Berwick Fruit Company, and was incorporated under the Nova Scotia joint stock companies' act, with an authorized capital of $10,000. Warehouse accommodation was secured, and during the first season some 7,000 barrels of apples were handled. This company did not limit its sphere of usefulness to the mere handling of apples, but it aimed, also, at being an educational power. The leaders of this movement soon found that one of the most important factors in successful co-operative fruit packing was the production of good fruit. The company therefore used its best influence to educate its members and also farmers generally in the matter of careful cultivation, spraying, and the other operations necessary to secure high-class fruit.

At the beginning of the second season the membership of this company had doubled, and a new warehouse was purchased.

In 1908 the output of this company was 15,000 barrels, which increased the following year to 22,000.

The early history of this company is a splendid demonstration of what can be done by a body of men associated together for the common benefit. The superiority of the pack put out secured splendid prices. While farmers outside the company had to be content with $1.25 per barrel, tree run, for their apples, the members of the co-operative company were receiving $2.65 for No. 1 grade of fruit, $1.90 for No. 2 and $1.22 for No. 3.

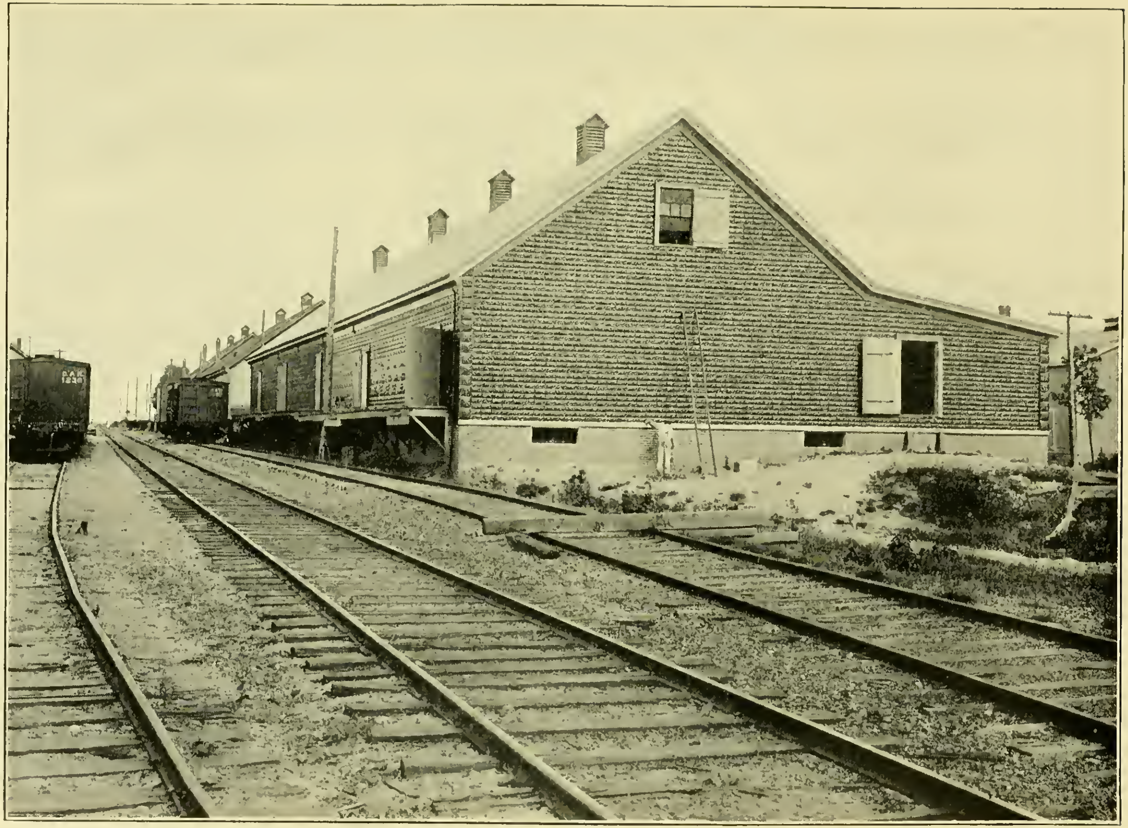
News of the phenomenal success soon spread, and in 1909 five more companies were incorporated under a new act enacted especially to facilitate the incorporation of such companies. The following year saw that number increased.

The apples of all members of co-operative companies are packed at the warehouses by experts. No farmer who is a member of a company is permitted to pack any standard variety at home, neither is he allowed to sell except through his company. Thus the companies are able to put up a uniform pack which they can guarantee. A farmer joining a company agrees to pool his apples, and he is paid the average price realized for each variety in the three grades. Thus there is a direct incentive to raise good fruit, for the member receives the average price for the grades into which his fruit packs.

It was realized, however, by the leader of this movement that while much could be accomplished by individual companies, it needed concerted action on the part of all companies to carry this co-operative idea to its logical conclusion. The companies were valuable factors in educating their members in the matter of cultivation, spraying, and improving the pack of their products. As individual companies working entirely independently of one another, however, they rather defeated the very idea of co-operation, because they really became competitors of one another. Speculators were wont to play one company against another, so that the superior pack did not make that extra money that its quality merited.

It was also realized that if the companies could work together large savings could be effected in the purchasing of supplies, such as fertilizer, nails, pulp heads and spray materials. The matter of transportation could also be better and more economically handled.

A conference was held and it was determined that some form of centralization was necessary. At this point, however, the Nova Scotia farmers showed that while they were ready to consider new ideas and act on them if their judgment pronounced them good, yet they would not "buy a pig in a poke." They decided, therefore, that they would give this centralization scheme a trial for a year and see just what could be accomplished before floating the Central as an incorporated body. An



Warehouse of the United Fruit Company, Berwick, Nova Scotia.

executive committee of three members was elected from the leaders of the companies, some twenty-two in number, who decided to participate in the movement. The farmers were fortunate in their choice.

As I stated before, the companies did not tie themselves to the Central Association in any way, they contributed nothing to found or start it, and were under no legal obligations to support it. The work of the Central was to attend to the matter of transportation, make what sales it could for the companies, buy supplies and generally assist all affiliated companies. Companies wishing to affiliate paid an entrance fee of $5. To maintain itself the Central charged the companies a small percentage of what apples it sold and earned certain money, as will be explained later. This Central Association came into existence in July, 1911. The whole scheme was an experiment, and no company was compelled to supply a single barrel of apples, to fill orders taken by the Central, if it thought it could do better elsewhere. Under these circumstances it is little short of wonderful that at the end of the season the manager was able to report an unqualified success. Great credit is due to the companies, the majority of which, I am glad to say, stood by their Central. There were a few weak-kneed companies, but these dropped out early in the game.

A brief résumé of the work accomplished by this experimental Central Association may prove of interest to you. In the first place Nova Scotia had that year a record crop of apples. The very magnitude of the crop gave the Central its first opportunity to demonstrate its usefulness. With such a large crop there was naturally a lack of laborers to harvest it. The Central advertised for help, and in response to their appeal a small army of laborers invaded the valley and were distributed by the Central to the various companies who had previously made their requirements known. These companies in turn passed the help on to each of the members who required it. Previous to this action by the Central Association the valley laborers were demanding an unreasonable remuneration for picking. The advent of the additional help, however, knocked the bottom out of this "hold up," and the growers, even those altogether outside of the movement, were able to harvest their crops at a reasonable rate.

It had long been thought that a good market for the farmers' Nova Scotia Gravensteins could be found in the Canadian west. This splendid apple never had a chance on the European markets on account of the large quantities of English fruit always available in those markets early in the season, and the lack of fast boats to place it on that market in prime condition. The Central engaged a man of marked ability as a salesman to go west and see what could be done. As a result of this short trip some 12,000 barrels were shipped to the northwest provinces by the Central Association. The opening up of this market has proved a great boon to the Nova Scotia apple trade, for, as is ever the case when a new market is found, the old markets were relieved and thereby steadied, resulting in better prices all round. Verily, in this initial year, the Central Association did not lack opportunities.

Take the matter of transportation for instance. The supply of steamships, usually all sufficient to carry the apple crop to European markets, proved totally inadequate to cope with the tremendous quantities of early fruit sent forward. The end of September saw the Halifax terminal blocked, its cars of fruit sweltering in the sun, and no boats to carry it to market. The Central Association quickly grasped the situation and dispatched four train loads to Montreal, connecting there with fast boats to England. This, however, was only done as a temporary relief. In the meantime they chartered four boats, which carried some 40,000 barrels out of Halifax, and so effectually relieved the situation to that port that a similar congestion did not occur again throughout the entire season. I claim that the farmers of the valley were saved thousands of dollars by this action. Not only did the members of the companies benefit, but the entire body of fruit growers. That action alone justified the existence of the Central, and should have earned for it the support of all fair-minded and clear-thinking men.

The Central Association also proved a great selling factor. During the season it sold for the companies 102,000 barrels of apples, and, what is quite as important, made good prices. Another very useful work accomplished was the securing of space on steamers and attending to the shipping of the companies' apples. During the season 400,000 barrels of apples were shipped on its bills of lading.

In the matter of marine insurance a great saving was effected. The fact that the Central had some 400,000 barrels to insure, secured for the company an exceptionally low premium, and materially reduced that little item seen on most accounts of sales, which in the course of a year amounts to a considerable sum. Insurance of the warehouses and contents was also effected at a very close rate, the Central earning the commission usually going to the agents.

Supplies were bought at very low figures. An order for 1,250,000 pulp heads and 500 kegs of nails naturally secured inside prices. The largest saving, however, was made in the purchase of fertilizers. Many companies who had stood loyally by their Central throughout the apple deals backed out when it came to buying fertilizers. Only a few companies, therefore, were working with the Central in this field, but even then 2,283 tons were handled. The fertilizer was bought at a saving, compared with the lowest price quoted by the agent, of about $3 per ton. Fertilizer agents assured the companies that they would guarantee them as low a price as the Central could give them, and others advertised openly in the press that they would supply fertilizer at even lower prices than could be obtained through the Central. Thanks, however, to the business acumen of the managers, the fertilizer agents were soon glad to withdraw those advertisements, and the companies who stood by the Central were able to divide a net saving of $6,800 on their fertilizer deal.

I know some companies whose lack of faith in their Central cost them $4 per ton on their fertilizer supplies. One should not be too ready, however, to blame those companies; after all it was only an experimental year, and it is not strange that some should look askance at the idea of giving their order blindly without knowing how much their goods would cost them. At the same time all the more credit is due to those who were sufficiently imbued with the right spirit of co-operation to do this.

The great thing for the individual to remember, however, in a co-operative movement, is that after all it is not a Central

Association selling you material; it is you yourself buying material at first cost through your own buyer, that is, your Central Association. The Central did not work to make any profit out of the affiliated companies. Supplies were distributed at cost and apples were sold at cost. A small levy was made on all apples sold to cover the expenses of the Central, but owing to the economical manner in which things were worked out, money being earned by the Central in various ways already indicated, the entire business of the companies was handled at the ridiculously low cost of three-eighths of a cent per barrel. Thus did the leaders of this movement demonstrate to the farmers what could be done by co-operation.

During the winter months a special bill had been prepared to enable the Central Association to be incorporated. This bill, with certain modifications, was passed by the House of Assembly at Halifax. Steps were taken in June, 1912, to complete the organization of this movement and to incorporate as many companies as possible into one central body.

The speculators who had so long made a very lucrative living out of the farmers did not allow this organization to be effected without a determined opposition, but thanks to the zeal and untiring energy which was put into it, twenty-four of the twenty-seven co-operative companies signed the memorandum of association, which gave birth to the United Fruit Companies of Nova Scotia, Limited. The company is incorporated with an authorized capital of $200,000, of which $76,000 is subscribed, each subsidiary company subscribing 20 per cent. of its authorized capital. The organization meeting was held at Kentville on July 8, 1912, the companies being represented by seventy-two delegates. By-laws were adopted and directors and officers were appointed, each company being represented on the directorate by one representative.

Ten other companies have been formed and have come into the Central Association since organization, so that there are now thirty-seven companies. All the companies agreed to come in under a by-law which gives the Central Association complete control of all their fruit. All apples are pooled and average prices are returned to the companies according to the class and grade of fruit packed.

Apples stored in United Fruit Company's warehouse, Kentville, Nova Scotia.

These companies collectively have a membership of about 2,500 of the most up-to-date and progressive farmers of the valley. The United Fruit Companies can therefore claim to have control of the best fruit produced in the finest fruit producing district in Canada.

There are forty-seven warehouses belonging to the companies, having a total frost-proof storage capacity of 750,000 barrels of apples. These warehouses are turning out on an average 25,000 barrels of apples a week. Eight steamers and ten schooners beside the regular boats have been chartered by the company. Three of the companies have erected evaporators, where the cull apples are used up, thus reducing waste to a minimum. It is the aim of the United Fruit Company to establish and maintain a uniform high standard of pack, which they guarantee. It is considered that in this way a demand will be created for co-operative packed fruit, which will naturally mean higher returns. Already the superiority of this pack has been noticed. Fruit inspectors have reported on it to Ottawa, and Ottawa in turn has congratulated the companies. Disinterested persons in various parts of Canada have commented on it in the press. And above all it is reported that the European buyers now look for and demand the co-operative mark. Thus it can fairly be said that the aim of the companies has been accomplished.

Great importance is attached to this matter of good pack, and to maintain uniformity the chief inspector visits every warehouse constantly; spending a little time at each, inspecting barrels packed, and giving instructions. His reports concerning conditions prevailing at each warehouse are carefully noted and filed.

New markets are constantly being sought, and in this connection much valuable work has been accomplished. Markets on the continent of Europe hitherto supplied through a series of middlemen are now being supplied direct, and trial shipments are being made to other hemispheres where the Nova Scotia apples, the apples with the flavor, have never previously been tasted, but where it is hoped a demand will be created. As the shipping season is only at its early stage, it would be premature to talk about what has been accomplished this year. Suffice it to say that up to October 31, 206,000 barrels and 42,000 boxes had been shipped, and quite a fair proportion of this quantity had been shipped to fill orders.

The wonderful success that has attended the co-operative movement is having a telling effect, and applications are being constantly received from responsible farmers asking for assistance in forming companies in their neighborhoods. Nine such companies are now in course of organization, and at the end of the apple shipping season a vigorous campaign will be conducted to still further extend the scope of this movement.

It is not proposed that the shipping of apples and furnishing of fertilizer shall be the sum and substance of this movement. A more ambitious program is mapped out. It is proposed that in time everything that a farmer requires on his farm or in his home can be purchased through the co-operative companies. Advertisements are seen daily, setting forth the advantage of buying direct from the makers. Through the co-operative movement the farmer will get his supplies direct from the makers, minus even the advertising expenses, and with all the saving in cost which is always effected when a large quantity of any material is bought. Through co-operation the farmer buys his supplies direct from the producer and sells his product direct to the consumer. The small army of middlemen, who have been making a comfortable living out of him on both sides, has to retire and he, the producer, gets the full value of his money on the one hand, and gets all the money that his produce makes on the other.

As I stated before, the United Fruit Companies have a very ambitious program. It contains such items as the erection of cold-storage plants, the running of a line of refrigerator cars, erecting or purchasing large department stores, erecting sawmills and cooperage and box-making shops, and even banking and insurance. Indeed the possibilities are unlimited. See what has been done in Europe. Who will say that what Denmark has accomplished is not possible in Canada?

One does not expect all this in a year, or two years or even five years, but given judicious management and capable officials in all departments and in ten years I look to see the United Fruit Companies of Nova Scotia the most powerful organization in eastern Canada.

The Central Association has an efficient office staff working on an organized system. Instructions are sent out from the Central office constantly to all subsidiary companies, directing as to varieties to be packed and how, when, and where to be shipped. Space on the various boats is allotted to the companies, and directions issued as to method of shipping, etc. Statistics are compiled showing quantity and condition of crop throughout the American continent and Europe. Constant telegraphic advices are received and recorded, giving total estimated shipments of apples from all ports to all ports. Prevailing conditions on all markets are recorded daily, and reports received from our representatives and agents from all markets touched by the North American fruits. All the reports are carefully studied and instructions issued as a result. The organized fruit growers of Nova Scotia this year demonstrated to the world that co-operation is a mighty factor.

As soon as the unreasonable increase of ocean rates was communicated to the Central office, it was recognized that unless immediate action was taken the Annapolis valley would be subjected to a tax which would be nothing short of murderous to its industry. The increase of 32 cents per barrel was utterly indefensible; the claim of the steamship companies that additional war risks had to be paid did not form sufficient excuse, as less than half the amount of the advance would more than cover any additional cost in that direction. It was simply an attempt on the part of the combine to take advantage of the war to make those who were forced to ship pay a rate that would make bigger profits for the steamship owners.

There were two ways of combating this menace; one, was an appeal to the government at Ottawa, and the other, was by chartering boats owned by concerns outside of the Atlantic combine. The United Companies pursued both courses.

A strongly worded protest was immediately mailed to the minister of trade and commerce. The shippers of the United States were also appealed to with a view to bringing pressure to bear on the combination through the American trade. It was found that the American shippers were all ready to co-operate with the United Fruit Companies, who were alone on the Canadian side in fighting the increase in a determined manner. The Dominion fruit conference was about to be held and the officials of the United Fruit Companies attending that conference were instructed to bring the matter up as an emergency.

In the meantime the strongest weapon of the organized fruit growers was used. Steamship brokers were instructed to ascertain what independent tonnage was available for chartering, and it was quickly found that no difficulty would be experienced in obtaining all the boats necessary to carry the United Fruit Companies' apples. The United Fruit Companies then informed the International Combine that they proposed chartering independent boats, and as an indication that this was no idle threat two boats were chartered. This had the desired effect and we were quickly notified that the steamship companies had decided to reduce the increase by 19 cents.

Now the moral to be drawn from this short but sharp fight is that organized and united the fruit growers of the valley are a power, a power that can demand and obtain fair treatment. The fact that the organized fruit growers were powerful enough to charter their own boats and powerful enough to be absolutely independent of the regular steamship lines has saved the valley 19 cents on every barrel of apples that will be shipped. Consider what this means. If only 600,000 barrels are shipped this year the United Fruit Companies will have saved the valley $114,000 — $114,000 in the pockets of the growers instead of the pockets of the steamship companies.

If the United Fruit Companies had not been in existence, the advanced freight rates would have gone into effect and the growers would have had to pay, or allow their fruit to rot. The few big shippers probably would not have paid the increase, but that would only be a repetition of what has happened previously, and the ordinary growers would have had to pay, while a few privileged individuals would not. By taking space and retailing it to smaller shippers, the favored few would have become just so much richer at the expense of their less fortunate brethren.

As individuals, the growers can do nothing; as an organized body working co-operatively, they are a power to be considered.

The co-operative movement in Nova Scotia is just what I say it has been. And I will quote from the annual report of the co-operative society for last year: "Your purchases for the past year have included 575,000 pulp heads, 35,000 pounds of nails, 67,800 pounds of grass and clover seed, 22,745 pounds of other seeds, 48,300 pounds of vetches, 4,500 bushels of seed oats, 2,060 barrels of flour [and they bought a lot more flour just before the war], 19,649 bags of feed, 6,044 tons of fertilizer, 104,000 pounds of arsenate of lead, 8,900 rods of steel fence, 1,800 barrels of lime sulphur, 2,200 pounds 'Black leaf 40.' These supplies have cost in round figures about $183,000."

Our country is especially fitted for co-operation, because the Dominion Atlantic Railroad runs from one end of the valley to the other, and the warehouses are dotted all the way from Digby to Yarmouth, and at Berwick we have six more. The central office does all the selling. They get their orders from England, from the Canadian west, or wherever it may be. Each warehouse is notified by telephone or telegraph how many barrels to put into that particular lot.

The great trouble we had was to get the farmers started. They are a suspicious lot of men, afraid somebody will make a dollar out of them. In Nova Scotia the great talk against the co-operative companies is that the manager is making some money. Of course you can't get a good manager unless you pay him. Last year it cost about 4 cents a barrel for all the apples that were handled by the co-operative company to pay the total running expenses of the whole business for clerks. We have a splendid system of bookkeeping, too. Every man knows what his apples bring, and we have auditors to handle the books so that there is no possibility of fraud, and up to the present date the movement is working very well indeed. Our apples go to Africa, Cape Colony, Glasgow, England and the Canadian west, and we are opening up a market now in South America. We sell very few apples in the United States.

QUESTION. In what condition are the apples when picked and taken to the warehouse?

MR. WOODWORTH. They are picked in the orchard carefully, and the early apples taken to the warehouse in barrels with a little bit of burlap and a hoop drawn over it. The later fruit is put in the barrel and the heads are put in upside down, and they are shipped to the warehouse and stored there. They are all put in in blocks, a block of Baldwins and a block of Greenings, and shipped out just as they are wanted. The warehouses are kept very neat and clean, too, and everything piled up in them, and it is a pleasure to go in.

QUESTION. How far are the warehouses from the orchards?

Mr. WOODWORTH. Oh, 4 or 5 miles at the most. Not 5 miles now, because you see the valley is only about 6 miles wide, and the railroad runs through the center. I am 2 miles from the station. We draw 35 or 40 barrels to a load and draw 4 loads a day. Pick up the apples, load them in the wagon and go right down and get your slip from the warehouse for every barrel of apples you put in.

QUESTION. You said you headed the barrels in the orchard.

Mr. WOODWORTH. Yes, we put the heads in upside down so that it gives a little more space. We do not press them down in the orchard; we shake them down, jar them down when we pick them, and then shove the head in.

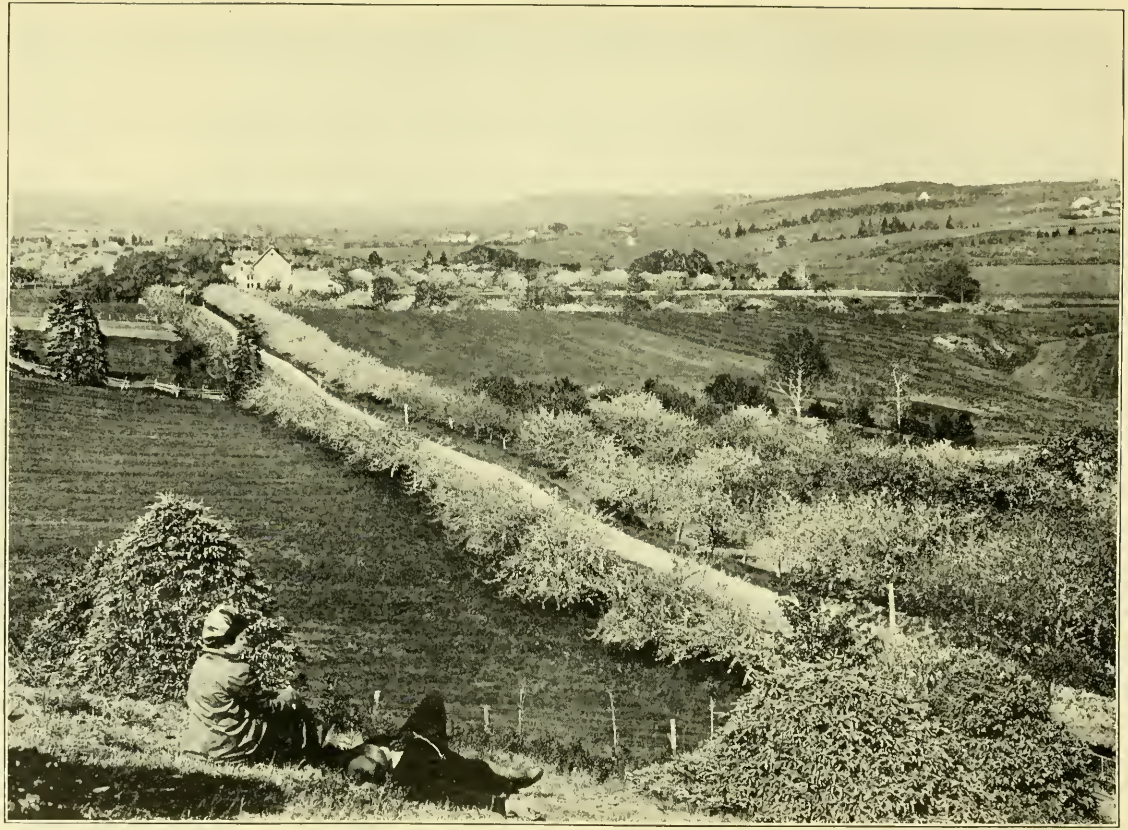
QUESTION. Are they all repacked?

Mr. WOODWORTH. All are graded and repacked at the warehouse.

Mr. WHEELER. I would like to ask if you consider the co-operative association takes the place of passing necessary laws, — for instance, a grading law?

Mr. WOODWORTH. Oh, no. These companies have to be looked after. I have got a copy of the inspection and sale act of Nova Scotia. If you people had this law it would be the best thing you ever had. I will quote one or two paragraphs: —

> Fancy quality, unless such fruit consists of well-grown specimens of one variety, sound, of uniform and of at least normal size and good color for the variety, of normal shape, free from worm-holes, bruises, scab and other defect and properly packed; No. 1 quality, unless such fruit includes no culls and consists of well-grown specimens of one variety, sound, of not less than medium size and of good color for the variety, of normal shape and not less than 90 per cent free from scab, worm-holes, bruises and other defects, and properly packed.



A view in the Gaspereaux valley, Nova Scotia.

Now, that is the No. 1, but they say there must be 90 per cent good, clean fruit. We intend they shall be all good clean fruit, but perhaps some man may not have good eyesight and they allow 10 per cent leeway — the law does — for some of that kind of stuff to come in.

> No. 2 quality, unless such fruit includes no culls and consists of specimens of not less than medium size for the variety, and not less than 80 per cent free from worm-holes and such other defects as cause material waste, and properly packed.

That is the No. 2 pack.

> In any package in which the face or shown surface gives a false representation of the contents of such package; and it shall be considered a false representation when more than 15 per cent of such fruit is substantially smaller in size than, or inferior in grade to, or different in variety from, the face or shown surface of such package.

You see, that fruit must be all the same all the way through. If you pack a box of apples down in our country and the face does not represent the whole, then you are hauled up.

> Every person who, by himself or through the agency of any other person, violates any of the provisions of sections 320 and 321 of this act, shall be liable, for the first offense to a fine not exceeding $25 and not less than $10; for the second offense to a fine not exceeding $50 and not less than $25; and for the third and each subsequent offense to a fine not exceeding $200 and not less than $50, together, in all cases, with the costs of the prosecution; and in default of payment of such fine and costs shall be liable to imprisonment, with or without hard labor, for a term not exceeding one month, unless such fine and costs, and the costs of enforcing them, are sooner paid.

Now, that is the law of our country, and it is enforced in Nova Scotia by about fifteen fruit inspectors, and those fruit inspectors appear constantly when you are packing apples in your own home, and are in the co-operative places every day. It has raised the standard of Nova Scotia apples above what it was a few years ago, and which gave Nova Scotia apples a bad name on the London market.

Whenever such violation is with respect to a lot or shipment consisting of 50 or more closed packages, there may be imposed, in addition to any penalty provided by this section, for the first offense 25 cents, for the second offense 50 cents, and for the third and each subsequent offense one dollar

for each barrel. This act is not only for Nova Scotia, but for all of Canada. Our fruit inspectors are at Halifax when the fruit is being shipped, — they haul up the barrels there, — and they are in the warehouses. They give no certificate, though, of inspection for any lot. They can't open all the barrels they go through.

QUESTION. What was the beginning of this law? What brought it about? Did it come through the growers?

Mr. WOODWORTH. Our Fruit Growers Association approached the government and blocked out a bill and got it passed through the Dominion Parliament. There has been some complaint from people who did not want to put their fruit up well. But the thing now has become a law and we have got to respect it, and I can tell you that I have packed 2,500 barrels of apples this year and we are very particular. Many men, perhaps, in this State do not need any law, but a lot of them do. If you could see some of the apples I saw at Lewiston last year, where a barrel was bought in the open market and brought in, it would make you smile. The man who packed those apples didn't know how to pack a barrel of fruit. Now, I have got about a quarter of an hour and I will give you some points in fruit growing in Nova Scotia.

Successful Fruit growing in Nova Scotia.

The Annapolis valley is situated between the North and South mountains, running from Windsor in the east to Annapolis Royal in the west. The average width of this valley is 6 miles, and practically all the apples grown in Nova Scotia are grown in this valley. Grand Pré, made famous by your poet Longfellow, is situated in the eastern section of the valley. Apple trees were first planted here by the Arcadian French. Some of these trees are still bearing fruit. The varieties grown are Gravenstein, Ribston, Blenheim, King, Golden Russet, Baldwin, Rhode Island Greening, Stark and Ben Davis.

In the year 1880 it was thought wonderful that 41,000 barrels should be exported, yet by 1911 the quantity had risen to nearly 2,000,000 barrels. New orchards are planted every year, and as yet only a small fraction of the total area has been set. Orchards that have been planted during the last twenty-five years are set 33 feet each way, which for a standard orchard is about right.

Special attention is paid by the successful grower to the following points: —

Cultivation. — Most of the plowing in the larger orchards is done in the autumn, preferably after the leaves have fallen. Early in the spring, as soon as the land is fit, the land is harrowed with disc harrows, followed in ten days with spring tooth and later with smoothing harrows. The cultivation is kept up every ten days until the 1st of July. At this time cultivation ceases, and the entire area is sown with a cover crop of summer vetches or tares. These vetches grow luxuriantly and produce a very heavy crop, which is plowed under in the autumn. This is of great value to the soil, as it adds an immense quantity of humus, which is heavily charged with nitrogen gathered from the air during the growing season by the millions of bacteria which are ever working, although unseen, in the interest of the orchardist. The conservation of moisture is one of the most important results of cultivation. The stirring of the top soil breaks up the capillary tubes that bring the water from below, and evaporation is checked. Two other advantages of cultivation are that soil under thorough cultivation has a larger amount of plant food available for plant use, and the finely pulverized soil offers no resistance to root development, and thus helps the trees to extend their feeding area.

Fertilization. — Another important factor in successful orcharding is keeping up the fertility of the soil. Without a generous supply of plant food the trees will not make a satisfactory growth or produce a paying crop.

For nitrogen, large quantities of nitrate of soda are used. Ground fish, obtained from the Fish Reduction Works at Carver, Nova Scotia, is a splendid fertilizer. Nitrogen is also supplied by manure and the plowing under of leguminous crops.

Basic slag from the steel works at Sydney, Nova Scotia, has been successfully used the past few years as a source of phosphoric acid. It also has a percentage of free lime which has a beneficial effect on the soil. In the past, large quantities of muriate of potash have been used in our orchards, but the farmers are not using much of late years, as our soils contain plenty of potash, which needs only cultivation to make it available. I might mention at this point that land of a wet nature must be thoroughly underdrained before success is possible. Trees will not do their best with wet feet.

Pruning. — Most of the pruning is done in March and the early part of April. Our trees are headed out about 3 feet from the ground, and are cut back a little each year so as to form a low-headed tree. A tree that is low headed presents many advantages over the tall slim tree. The former is easily sprayed. The picking of the fruit can be done with much greater care. The tree itself is much stronger, and is not affected by winds.

Spraying. — The operation of spraying is not a pleasant one. Spraying has become universal in our valley. For a long period Bordeaux mixture and Paris green was the spray used, but of late years lime-sulphur with arsenate of lead as a poison has almost entirely taken the place of the former.

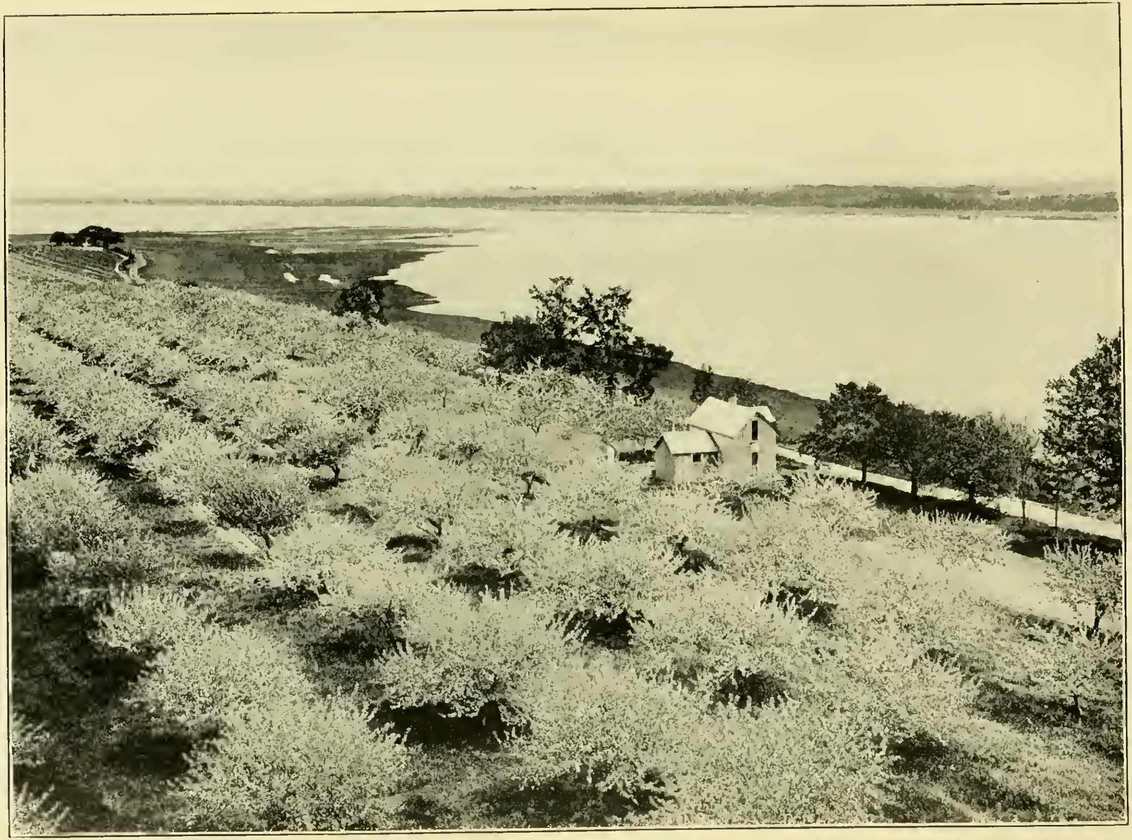
The black scab or spot is the greatest enemy we have to fight. Spraying should be done while the trees are dormant, with the 1 to 8 or 1 to 9 mixture of lime-sulphur; then before the blossoms open, with lime-sulphur 1 to 40, and 2 pounds of arsenate of lead; and again after the petals have fallen, with the same mixture; and if necessary, after another period of ten days. Fine, thorough spraying generally does the work. The operation must be thoroughly done and every part of the tree must be reached. Power sprayers are used in almost every instance.

QUESTION. What variety of vetch do you use?

Mr. WOODWORTH. Just the common vetch or tares, not the hairy vetch, which is more expensive. The vetch we use costs $2 a bushel.

QUESTION. How much do you seed to the acre?

Mr. WOODWORTH. One bushel. Have your land in a good state of cultivation, then just go over it with a smoothing



Apple country in King's County, Nova Scotia, looking toward Grand Pré.

harrow after you sow your vetches. They grow fast and form a nice bed for the apples to fall on later.

QUESTION. What do you pay for basic slag?

Mr. WOODWORTH. I have to pay $13 for basic slag through the companies, and I think it is 12½ per cent of phosphoric and about 40 per cent of free lime. It has quite a high percentage. You know they put the limestone into the furnaces at the steel works and the dross comes out, and the finer it is ground the better for us. This works splendidly on the low lands on account of the phosphoric acid it contains.

QUESTION. Are you troubled with the aphis?

Mr. WOODWORTH. Yes, we used to be. You must keep in touch with the professors so as to know when the aphis is coming.

QUESTION. How can you tell whether you are going to have it or not?

Mr. WOODWORTH. You can see these little aphides very early in the spring. Quite a lot, I believe, depends upon the season. But we examine our trees with a glass just as soon as the very first leaves commence to show, that is, when the little aphides hatch, — and we get intelligence, too, from all over the valley, — from the fruit companies, — and the spraying is all done about the same time of the year. The indications for aphis are reported at the central office, and we have a co-operative newspaper which spreads the news all through the valley, which is a great aid to us.

QUESTION. Do you have the tent caterpillar?

Mr. WOODWORTH. Yes, a few. But, as I say, the black spot is what we are fighting, and I expect it is the damp weather conditions that cause it down there.

QUESTION. Do you use any Bordeaux in fighting the black spot?

Mr. WOODWORTH. We used to rely on Bordeaux. I used to go around the country with lime and blue vitriol and mix Bordeaux, and show the farmers how to apply it; but since lime and sulphur came in I have used Bordeaux only one or two years. Lime-sulphur has taken its place. The only objection I have to Bordeaux is that it russets the apples. I can't grow apples unrusseted by the use of Bordeaux, and I can grow clean fruit with lime-sulphur.

QUESTION. Do you ever have any trouble with burning foliage with lime-sulphur?

Mr. WOODWORTH. No. I don't think there is any trouble with burning the foliage if you don't get your mixture too strong.

QUESTION. What do you pay for commercial lime-sulphur?

Mr. WOODWORTH. Eight dollars a barrel, 40 gallons. If you want to make lime-sulphur cheap, get some brick, a 2-inch plank, make a little brick furnace with a wooden box with a sheet-iron bottom, about 6 feet long and 35 inches broad, nail it on with two rows of tacks, put a bit of stove pipe up through the end for a draft, and put in a hundred weight of sulphur to 50 pounds of lime, and boil it one hour and draw it off. Take a hydrometer and test it, and use it according to the hydrometer test. The test of the hydrometer gives the strength. You have to pay $2.25 for the sulphur and about 25 cents for the lime. In April you can boil your lime-sulphur when you are doing nothing else, and I have saved $50 this year.

QUESTION. What formula do you use for Bordeaux mixture?

Mr. WOODWORTH. Forty gallons of water and 4 pounds of blue vitriol and 4 pounds of lime. You should dilute the 4 pounds of blue vitriol with 20 gallons of water in a barrel, and the 4 pounds of lime with another 20 gallons of water, and then pour simultaneously into a third barrel; if you don't do it this way your Bordeaux is no good.

QUESTION. How much growth do you get on a tree?

Mr. WOODWORTH. On a tree that is fruiting never over 4 or 5 inches of growth.

QUESTION. Do you thin your apples?

Mr. WOODWORTH. Well, we want to; it is a hard proposition, the thinning of fruit. We have only thinned a very few trees, and I know that it is the right thing to do, but we have not done it. Our best fruit growers do. Thinning will become universal in a little while.

QUESTION. Do you raise any small fruit along with the trees?

Mr. WOODWORTH. If you grow small fruit the raspberries and strawberries sap the soil of its fertility. I have always noticed that where a man grows strawberries between the trees his apple-tree leaves are all yellow. We grow apples and turnips and get huge crops in between the rows.

QUESTION. Are not currants good?

Mr. WOODWORTH. We never grow any currants between the trees. We grow some raspberries.

QUESTION. At what age do your trees bear?

Mr. WOODWORTH. Well, the Wageners begin to bear about three or four years after they are set out. Of course, they are small trees and can't bear very large crops. I have an orchard planted out about thirteen years, — 30 acres of orchard, — and that has given me a splendid crop, averaging 50 bushels to the acre; that would be a barrel to a tree. Of course, some trees have two barrels on; others don't have any.

QUESTION. What do your apples bring a barrel this fall?

Mr. WOODWORTH. Our apples for export have brought about $1.60 through the co-operative companies. You count that a small price; for these war times we count it a very good price.

QUESTION. How much is the profit on a barrel of apples at that price?

Mr. WOODWORTH. Fifty cents. We pay 28 cents for barrels; it costs us about 12 cents to get them packed; they do it a little cheaper this year than they have been doing it. Of course, in the co-operative movement we have to pay for what it costs.

QUESTION. You pay for picking?

Mr. WOODWORTH. We pay for picking usually $1 a day. I have paid more. If we could get experienced pickers we would pay them more, but we usually get new pickers each year, and if you have ever attempted to pick apples with a lot of fellows that never had picked them before you know that all you hear is a basket falling, or a man, and by the time you have them well taught the season is over.

QUESTION. Is the business done through your co-operative societies done on a cash basis?

Mr. WOODWORTH. Yes, we sell all the stuff for cash, except what we send to the other side, and on that the returns come back as soon as sold.

QUESTION. What temperature do you keep in the warehouses?

Mr. Woodworth. We try to regulate the temperature as well as we can, but you see when in the autumn days it gets hot, as it did last year, the temperature gets very high, and we counsel our co-operative fellows to keep their fruit at home when they can, — not to haul off too much fruit early. We have no system of cold storage yet; we are talking about it. It would be a pretty nice thing for us. We have accomplished much, and the Nova Scotia co-operative companies are the talk of all western Canada. We are way ahead of Ontario along that line, and we feel very proud that we have made such a business of it. We have a very fine secretary and a good business man. Every central office employs a manager and bookkeepers, and each co-operative company has a manager and head, and then the girls and young fellows do the packing. The apples are all sorted in baskets. The African trade requires box stuff. Think of sending apples to South Africa, 3,000 miles. We sell large quantities of fruit right from the warehouse. About all fruit sold to the Canadian west is by the carload.

Question. What is the inside measurement of your bushel box?

Mr. Woodworth. Eleven by twenty. It is a longer box than the so-called standard, but not so deep. It holds a bushel.

Question. Is it 10 by 11 by 20?

Mr. Woodworth. Yes; I think that is the measurement. Our barrel is smaller than yours. I think our barrel is like the New York State barrel.

Mr. Wheeler. This Oregon box is 10½ by 11½ by 18. We have no law in this State requiring any size.

Mr. Woodworth. Of course, there is a call for boxed stuff, but the majority of our trade is packed in barrels. The size of our box is regulated by the Dominion government. You will never feel happy until you get a good stiff law on about inspection; it is one of the very best things for any agricultural or any fruit-growing district. There will be a lot of kickers at first, but they will all disappear.

Second Day.

The second day's meeting was called to order at 10.30 A.M. by Secretary Wheeler, who introduced Mr. George E. Taylor, Jr., of Shelburne as the chairman of the meeting.

ADDRESS OF MR. GEORGE E. TAYLOR, Jr.

Mr. Secretary, Ladies and Gentlemen: Yesterday afternoon we heard complaints voiced here on the decrease in the number of dairy cows in the State of Massachusetts. The reasons ascribed to that decrease may or may not coincide with your ideas. I think that there are reasons that were not brought out. I believe that the labor question is one affecting that problem as much, perhaps, as any one item. A man who has twenty cows to milk and has to get along with help who are rather particular about working more than eight hours a day is rather in a hole. Now, it seems to me that the cost of production of milk and the selling price of the same are in too close a ratio. I was rather interested this summer in watching the workings of our Franklin County Dairy Improvement Association and the results obtained by that association. We figured the cost of the milk production very closely and the selling price of the same. Taking the cost of the food value alone, the actual food-value cost of the milk was from 2¼ to 3¼ cents. We did not take into account interest on the investment or depreciation, the cost of selling or the labor required in the care of the cattle. So that you can see, if you are selling milk for 4 cents, and the actual food cost of the same is 3¼ cents, you are not getting out whole. Lots of milk is sold as cream to the co-operative creameries that does not bring 2½ cents. Now, the price of beef in the Chicago market is from 7½ to 11 cents a pound on foot. This, I think, is one factor that has made the decrease in the number of milch cows in the State of Massachusetts. If you can get $75 for a good cow for beef, when you are getting 3 or 4 cents a quart for your milk, the chances are you may let her go for that reason. That is one reason why we get the decrease in the number of cows. Now, it seems to me that taking those considerations together here under our conditions in Massachusetts, — the comparatively low price of our milk and the comparatively high price of beef, — we are beginning to see the value of getting these two factors in an animal together. When we can produce an animal which will make good in the dairy and pay for her feed, and at the same time make a good carcass of beef that will sell for 10 or 11 cents on foot, there is something in it. I would say parenthetically that this is the class of cattle we have when we are breeding dairy Shorthorns. And the consideration for our meeting this morning is our beef question in New England. It is to be presented to you by Professor H. H. Wing, professor of animal husbandry of the New York State College of Agriculture, whom I will now introduce to you.

BEEF PRODUCTION IN NEW ENGLAND.

HERBERT H. WING, PROFESSOR OF ANIMAL HUSBANDRY, CORNELL UNIVERSITY, ITHACA, NEW YORK.

I am asked to speak to you on the subject of beef production. I have taken the liberty to broaden the subject, and if you please, will attempt to discuss the whole question of meat supply in its relation to the New England farmer.

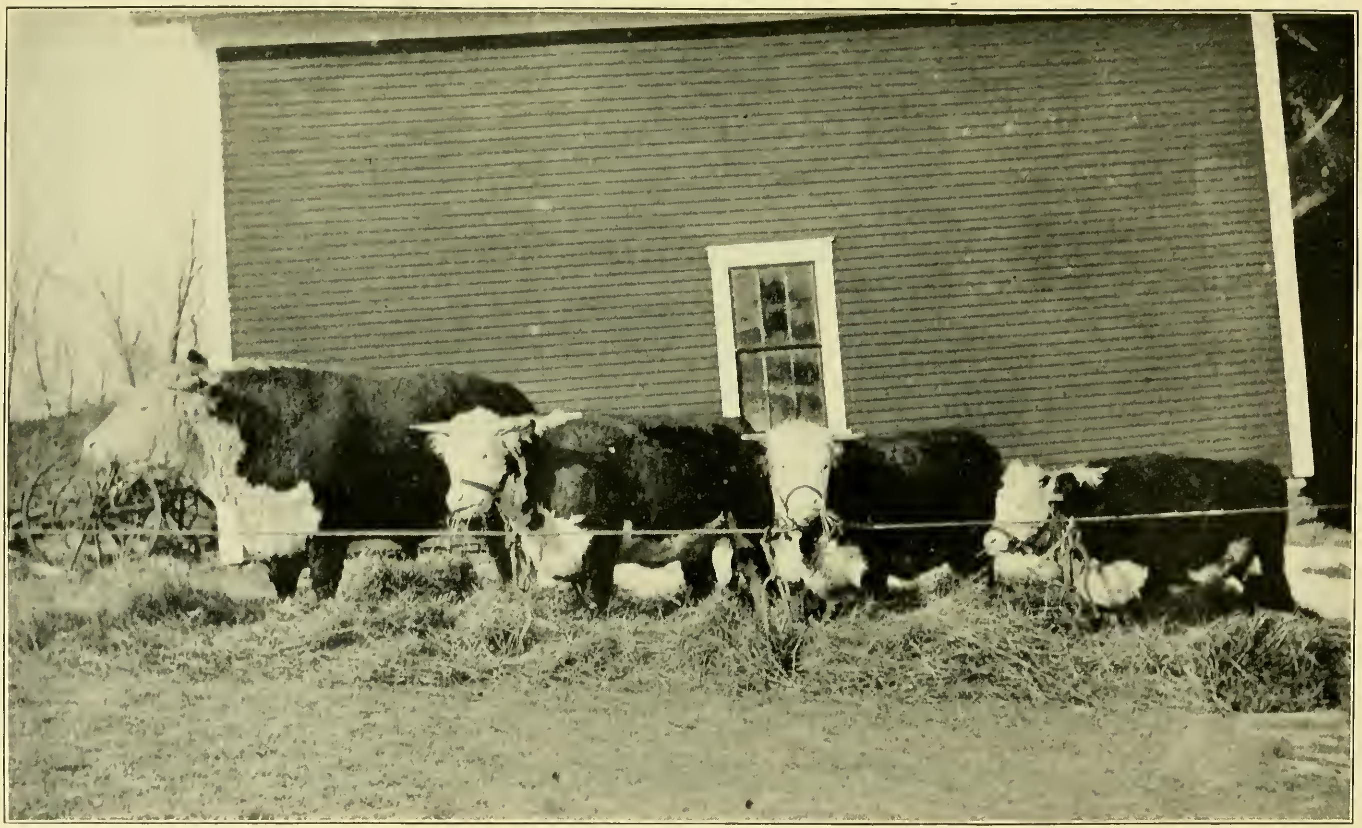
Much attention has been given to the number of meat-producing domestic animals in the United States, particularly since the Federal Census of 1910 called attention to the fact that there had been a sharp decrease in the number of such animals during the preceding decade. This was the more noticeable to the public, since the first sharp increase in price occurred at about the same time. Students and statisticians who had given attention to the question of meat production in the United States had long been aware of the fact that meat-producing animals were relatively decreasing, but as these matters were largely confined to trade journals and occasional references in the agricultural press, the general public remained to a large extent indifferent to them. It might be well for us to briefly review the condition of the country and more especially of New England with respect to the numbers of meat-producing domestic animals, and since dairy cattle are intimately associated with meat-producing animals and the meat-producing industry, these have been included as well. In order not to burden you with extensive quotations of statistics, I have arranged the most important figures on a chart, so that you may the more readily see at a glance the more important facts.

CHART No. 1. — *Live Stock in the United States.*

	1900.			1910.		
	Number.	Per 1,000 of Total Population.	Per 1,000 of Rural Population.	Number.	Per 1,000 of Total Population.	Per 1,000 of Rural Population.
Cattle, dairy,	18,108,666	238	401	21,795,770	237	442
Cattle, other,	51,227,166	674	1,133	41,886,878	455	849
Swine,	64,686,155	851	1,431	59,473,636	647	1,205
Sheep,	61,735,014	812	1,366	52,838,748	575	1,071
In New England.						
Cattle, dairy,	893,478	160	796	841,698	128	767
Cattle, other,	713,137	128	636	494,852	76	451
Swine,	362,199	65	323	396,642	61	361
Sheep,	922,558	165	822	430,672	66	392

Giving our attention first to the country at large, it will be seen that, with the exception of dairy cattle, all other classes have not only relatively but actually decreased in the decade from 1900 to 1910, and that while dairy cattle have increased in the same period something more than three and a half million, this has been barely sufficient to keep pace with the increase in population.

The next matter to which I wish to call your attention is the relatively small numbers of all classes of domestic animals in New England as compared with the country as a whole, particularly meat-producing cattle, sheep and swine; and to the further fact that all classes, dairy cattle included, have shown a marked decrease in New England during the decade. In this connection it is of course necessary to consider the two classes of population: the consumers, most of whom dwell in the cities; the producers, or those who live in the rural districts. The United States Census divides the population of the country into urban and rural population, including in the urban population all those who dwell in cities or incorporated villages of 2,500 inhabitants or more. As you know, New England differs from the rest of the United



A herd of New England Herefords.

States in some important features of municipal organization, and has no unit comparable with the incorporated village in other parts of the country, so that the census officers, in making this distribution of the population, have classed as urban all those New England towns which contain 2,500 or more inhabitants. Many of these towns have, of course, considerable areas that are truly rural in their character, so that the rural population may perhaps be slightly decreased in New England from this cause.

In the United States, as a whole, in 1910, 53.7 per cent. of the total population were classed as rural, whereas in New England only 16.7 per cent. were so classed. This shows a much larger proportion of urban population in New England than in the country as a whole, which no doubt largely accounts for the small numbers of domestic animals in New England in proportion to the total population. I have further compared the numbers of animals in the whole country and in New England on the basis of the rural population rather than the total population, as the census reports show that the rural population per square mile in New England is practically the same as the average of the whole country, the figures being 16.6 persons per square mile in the United States as a whole, and 17 in New England. Arranging, then, the census statistics of the animal population on the basis of the rural population we find that, as compared with the country as a whole, New England had in 1900 nearly twice as many dairy cattle as the average of the whole country, and that while dairy cattle had undoubtedly increased as compared with the rural population in the whole country, they had decreased from 796 per thousand to 767 per thousand in New England, showing that even in this most important branch of animal husbandry there had been a marked decrease in the last decade. The numbers of cattle, other than dairy cattle, swine and sheep, it will be seen are markedly less, ranging from less than one-third to about one-half as many in New England as in the country as a whole, and the numbers of swine alone show a slight increase in the decade; but it will be seen that the total numbers of swine are still insignificant in New England as compared with the country as a whole.

The statistics further show clearly what is apparent to most people, — the relatively great importance of the dairy cow among the animals of the farm, particularly in New England and in the northeastern States generally.

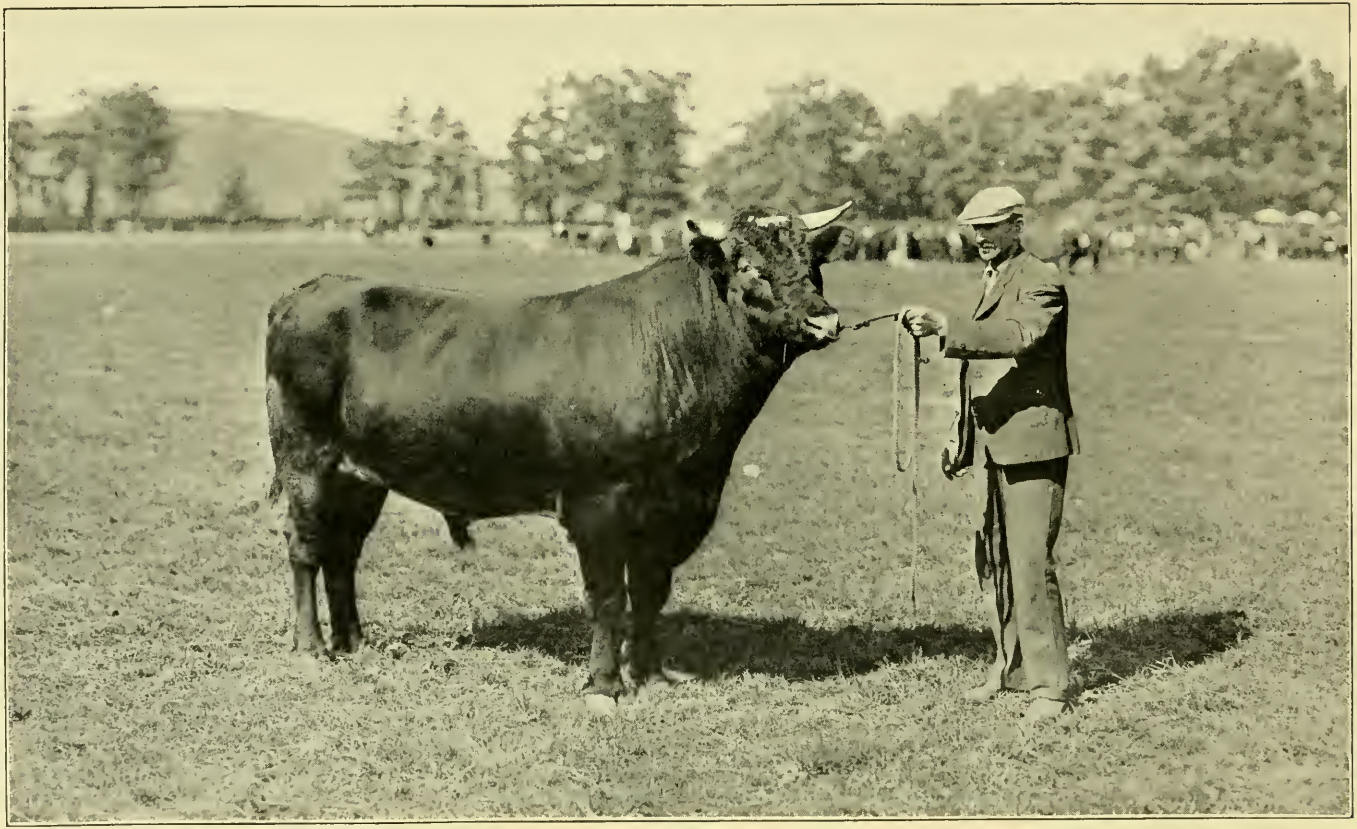
The present high price of not only beef but of all meat products, with no indication of a lessening price in the future, has brought home the question of meat consumption with great force to a large proportion of the consuming public, and the problem that confronts a great many people at the present time is the source of the meat supply in the home. Without attempting to take up the question as to whether the people in the United States eat more meat than is necessary, and the relative advantages and disadvantages of a vegetarian diet or any similar matters, I think it is safe to assume that the per capita consumption is likely to decrease, but I think that most of us, inheriting the ideas of our beef-eating English ancestors, will go a long way before we entirely forego meat as an important part of our dietary. It behooves us, then, as farmers to bestir ourselves to discover if we may not produce more meat as a profitable part of our farm industry. It is not necessary to call your attention to the fact that the conditions in the United States with regard to the production of beef have been anomalous for the last fifty years. In this time vast areas of fertile soil have been opened up for settlement and development. The crops easiest to produce on these vast areas have been grass and the cereal grains, notably corn, and the latter has been produced in abundance far beyond the capacity of the people to use as grain. A large part of this raw material has naturally gone into beef as the easiest method of marketing this crop, without regard as to whether such a practice was on the whole an economical one. We therefore became, and have remained up to the present time, a beef-exporting country, and beef has been relatively cheap. The ease of its production in the central west has put the eastern farmer entirely out of competition in the production of beef.

Two factors have been prominent in causing a decline in meat-producing animals: first, the taking up of vast areas of practically free pasturage upon which beef-producing stock could be raised; and secondly, the increased use and market for cereals, including corn, and the marked increase in the export demand for such cereals, which has relatively raised the price of the material upon which range-grown animals were fattened. During the past ten years the middle west farmer has found it less and less profitable to market his corn in the shape of beef or pork, and so the relative numbers have declined. If the consuming public continues to demand beef so that the price rises sufficiently we shall undoubtedly continue to produce it, and largely in the corn-growing regions of the middle west; but the western farmer will not in the future be as strong a competitor of the eastern farmer as he has in the past. What outlook, then, does the production of meat afford to the New England farmer under present conditions? New England will undoubtedly continue to import a large proportion of her meat supply. As the prices rise the per capita consumption will undoubtedly decrease. In either case, however, the New England farmer, constituting only about one sixth of the population, would seem to be assured of a permanent market at his own doors. The proportion of such market that he can supply will depend very largely upon his own intelligence, industry and business ability.

Along what lines, then, is it probable that profitable meat-producing farm industries may be increased? Inquiries and correspondence coming to me during the last two years have shown that there is considerable interest in the question of increased meat production in northeastern United States. This correspondence has come in considerable degree, not so much from farmers as from city people looking toward agriculture as a means of investment or employment. Nearly all such inquiries assume that if meat production is to be increased in the east it must be as a special, highly developed industry, and questions as to the proper places for specialized sheep farms, swine farms and beef farms, as distinct branches of agriculture, have been numerous.

If the meat products in New England are to be increased I see little indication that it is likely to come in this specialized form, but that it is much more likely to develop in connection with dairying, fruit growing or with other branches of agriculture; and other countries give evidence that this is likely to be so. England and Holland are two countries, both using considerable amounts of meat, both meat-importing, and both producing beef in sufficient amounts to make it an important part of the income of the rural population. The English farmer produces a few steers or a few wethers as a part of his general farm plan, and not, in most cases, as a special industry to which he devotes his whole attention; and it seems to me that if this same idea could be carried out among our New England farmers it would result in a notable increase in the meat output. The means of doing this I have not the time to discuss in very great detail, but I would like to call your attention to a few features of the matter. In the first place, I do not believe that beef production in New England is going to take the form of keeping a cow to grow a steer that shall be kept until he is two and a half years old, and then fed for ninety to one hundred and twenty days on clear corn the whole time; neither do I believe that the New England farmer is going to produce beef by crowding a calf with all the milk it can consume for six months, and then with a rich diet of heavy, concentrated food for nine months, in order to make the so-called "baby beef." Profitable beef production in the United States, and particularly in New England, must get away from the idea that unlimited consumption of highly concentrated food is necessary; and then we shall produce beef in the future, perhaps not of the superlative quality we have demanded in the past, but still of good, succulent quality, able to nourish any man, very largely from coarse forage in the form of silage and grass. Several of our western experiment stations, notably the one at Purdue University, have been working on the question of beef production through the consumption of silage. Silage has revolutionized the dairy industry in the northeastern States, and I venture to predict that it will have a similar effect on meat production. As a matter of fact, meat production for the New England farmer seems to hinge very largely on his capacity to produce more grass or more corn silage or both.

Another feature that we cannot lose sight of — and it is perhaps somewhat heretical to mention this — is the question of combining dairy and beef production. In the countries I



Dairy Shorthorn bull, Franklin County, Massachusetts. A good dual purpose type.

have mentioned with similar conditions, as in New England, dairy production and meat production go hand in hand. Short Horn cows produce a very large part of the dairy products in England. The Dutch farmer depends upon his veal calves, his surplus young cows, his bulls and an occasional steer as an important supplement to the cheese and butter that he makes from his cows. Cow beef, I am well aware, is tabooed, and perhaps, with the great attention we have given the extreme development of the dairy cow, justly so; but the matter keeps coming up with increased force as to the possibility of producing a cow that shall yield enough dairy product to give a profit to her owner, and at the same time produce a calf and carcass that will make a good amount of meat of at least fair quality. The increased interest in the so-called "Dairy Short Horn" is only one indication of this possibility. The fact that the highest type of development of dairy and beef animals up to the present time has been in separate individuals does not, to my mind, preclude the possibility of a profitable combination of these qualities in a single animal. It is undoubtedly more difficult of accomplishment, but the fact that it is difficult should be an incentive rather than a deterrent to the enterprising New England farmer.

The question of meat supply should not be closed without some reference to the smaller animals. Chart No. 2 shows how the value of all the farm live stock increased between 1900 and 1910.

CHART NO. 2. — *Value per Head of Live Stock in United States.*

	1900.	1910.
Dairy cattle,	$29 68	$34 56
Other cattle,	21 78	24 50
Swine,	3 69	6 88
Sheep,	2 77	4 44

The history of other countries has been that as the population increases in density a larger proportion of the meat supply comes from the smaller animals. So it is likely to be in the United States. I want to call your attention to Chart No. 3, which shows that beef is the most expensive animal product to produce, and milk the cheapest — the other products ranging between these two extremes.

Chart No. 3. — *Dry Matter in Food required to produce One Pound of Edible Dry Matter in the Product.*

	Pounds.
Dairy cattle, milk,	5
Swine, pork,	8
Fowl: —	
Eggs,	14
Meat,	15
Sheep, mutton,	17
Beef cattle, beef,	23

We may come to a time when we cease to eat beef, but afterward we will still have sheep, swine and poultry to fall back upon. In the development of both sheep and swine in New England it seems to me that there is an opening for increased effort, not as a specialized industry but as a side development along with other lines of effort. New England was once pre-eminent for its sheep. While this pre-eminence may never come back, it seems to me that there are a good many localities and conditions where an increase in sheep husbandry might be attempted with profitable results. The question of the dog in regard to sheep husbandry has often been a prominent one, and is often urged as an objection, but with the modern forms of fencing, the danger from this source is greatly lessened if not entirely done away with.

Swine may be increased so as to practically supply the local markets. One important feature in the present conditions of animal husbandry in New England has undoubtedly been the absorption of the markets by the large wholesale concerns, and this will undoubtedly have to be reckoned with. Success in increased meat production in New England will undoubtedly depend upon developing small local retail markets. This may be difficult in some cases, but some personal experience has given me good illustrations of the comparative ease with which such local markets can be developed. This would seem to be a good field for co-operative effort in many cases. In very many communities the establishment of a local country market provides a very acceptable outlet for both producer and consumer.

Mr. WHEELER. I would like to ask Professor Wing if he thinks it would be advisable in this part of the country to bring in partly grown steers from the south or west and attempt to fatten them here.

Professor WING. I don't believe that it can be done at a profit if you have to depend upon purchased grain.

Mr. WHEELER. Suppose you can grow your own feed?

Professor WING. Then, so far as feed is concerned, you can get more out of it in the production of either milk or pork. If the labor is as important a factor in the cost of production as the feed is, then the decreased amount of labor in producing meat may offset the increased cost of feed, and that, as I said, is a question that will largely be determined by local conditions. I am inclined to think, however, that where you want to increase the amount of meat or beef production you will be much more likely to do it by producing your own feeding stock.

It seems to me that the question of meat supply is very closely connected with the question of the production of more grass and of more corn. The corn need not necessarily be raised for grain, because the results of experiments at the Purdue Experiment Station have shown the great value of silage in the production of beef. Now, silage revolutionized dairy practice in New York and New England. Our dairy stock probably would have gone the way of our other animals to a greater extent than they have if it had not been for the silo. Now, it is entirely possible that the use of the silo may help us to partially revolutionize the beef production, or may be a great aid in the increased production of beef in the northeastern United States. If you can raise more corn and more grass on your farms you can grow more cattle, and, as they used to say in New York about pigs, you will have more manure to make your crops grow, until you have filled up these New England valleys completely with corn and cattle and grass.

Mr. WHEELER. Don't you think that our problem here in restoring the utility of our lands is in raising more animals, and don't you think that our land is more adapted, in a sense, to raising beef animals than dairy animals?

Professor Wing. No, I would not give up the dairy cow in any part of northeastern United States. You can't make digestible human food any more economically from any domestic animal than you can from the dairy cow. Now, if the labor bill does not get so high as to preclude dairying, she is going to be the predominant animal in all of this thickly settled country. If we do produce more beef, all the indications that I can discover point to the fact that increase in meat production will only be a supplement to dairy production. I don't believe you are going to keep less cows, but you are going to keep, perhaps, more beef animals. I don't believe that dairying is going to be a less important part of your industries is, perhaps, a better way to put it.

Mr. Russell. Do I understand that you are advocating the dual-purpose cow?

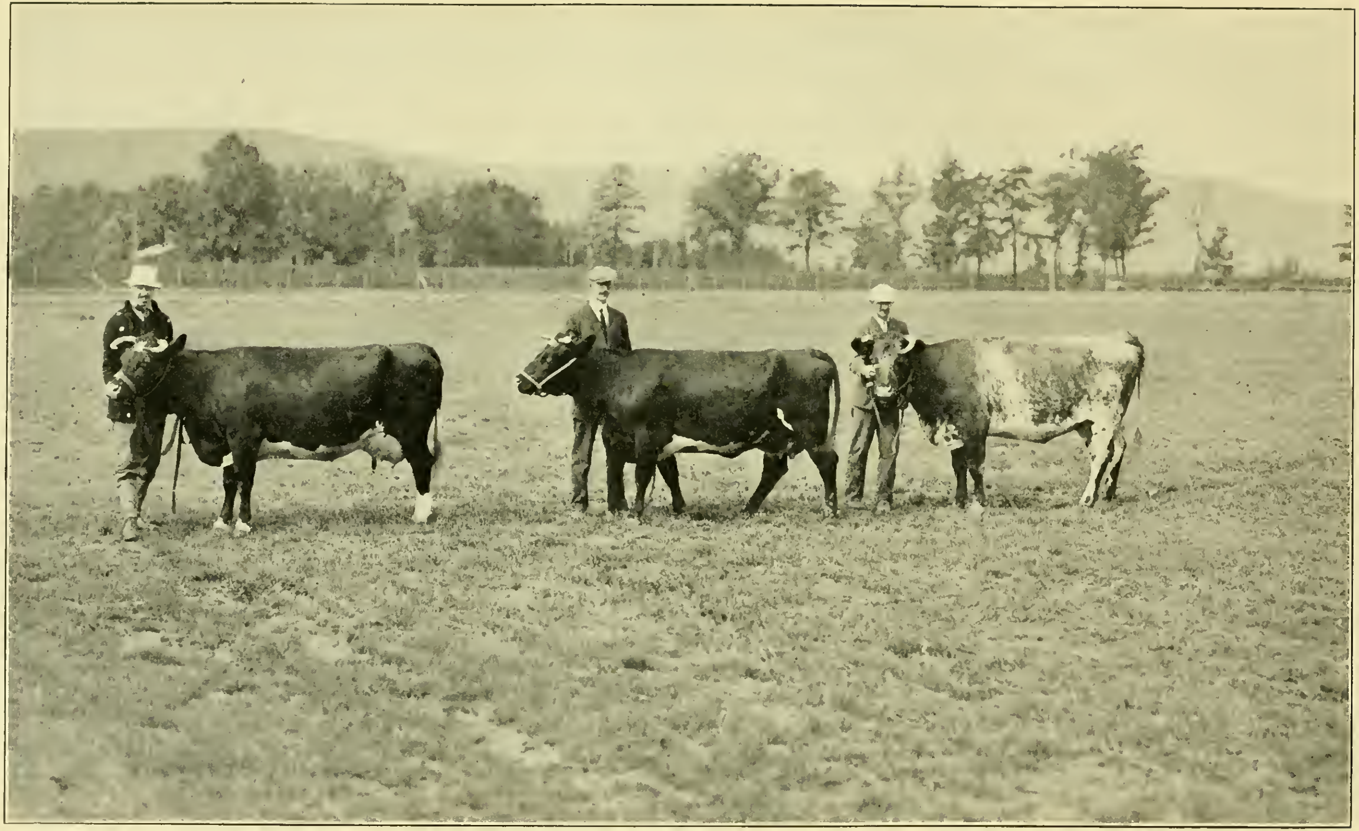
Professor Wing. Yes, I am advocating the dual-purpose cow. That is heresy. I may be drawn and quartered for doing it, but the time has passed when we can keep a cow in the west solely for her calf, and the time has passed in the east when we can keep a cow and totally ignore the value of her carcass, or her son's carcass.

Mr. Russell. That is, you believe that milk at 4 cents a quart is better sold than fed to a calf for beef?

Professor Wing. Probably, yes.

Mr. Wheeler. I don't think Professor Wing quite understood my idea; that is, not to do away with dairy cows at all, but to utilize an enormous amount of land in the hill towns of Massachusetts where the transportation problem practically makes dairying impossible. Don't you think it is more profitable to keep beef animals in those sections than it is to attempt to do dairying in those sections?

Professor Wing. Very likely. But that will mean, in the first place, that those areas will have to be better farmed than they are now; that is to say, we have got to stimulate the growth of grass. At first in these hill towns on this rough pasturage you should try sheep, and very likely you would find after the sheep had cleaned these areas up the grasses would come in, the land would get a little more fertility, and then it would support beef. But it seems to me there is



Dairy Shorthorn cattle, Franklin County, Massachusetts.

abundant opportunity for development along that line. It is, however, going to be done slowly. You are going to do it first on farms where you have some tillable areas; where you can produce silage and hay and use your upland pastures. Grass grows native in New England; if you will give it a chance it will come in. It only requires a little additional fertility. I believe, too, that one reason for the present condition is that same factor of competition that we had in the west. When this strong competition in beef production came from the west we let those things go. Now the question is, whether the time has not come when we can diversify our industries and gradually work into a better development and better utilization of these areas.

Mr. Wheeler. What do you think of our lowland? Here in Massachusetts we have some 500,000 acres of lowlands, at the present time practically untillable, too wet to cultivate, yet growing big crops of grass and cheap hay, which of course now is used largely for bedding purposes. I don't mean salt marshes but fresh marshes. Are those practical to use, a part of the year at least, for beef animals?

Professor Wing. Oh, yes. Just as soon as it will pay you to drain them. All of this waste land is to be drained and utilized eventually; the question is, how soon and in what way. The answer to that question will depend upon the cost of drainage. There you are going to produce just exactly the material to make a cheap meat.

Mr. Wheeler. I mean, before they are drained, — in their present condition?

Professor Wing. I am afraid not. Those sedges and other coarse foods of that sort you can't utilize very much more for beef than for any other purpose.

Question. I believe there is one phase that has not been brought out. I don't know how it is in New York State, but around here, for a good-sized calf that weighs from 80 to 100 pounds, they will give about $5 when born. Within two years I have known of a calf being sold in Spencer for $22.50 when it was only eight weeks old. Now, the temptation is for the farmer to take his $5 for the young calf, or $15 to $25 for the ordinary calf for veal, rather than to keep it until it is a year old and sell it for the same money. As far as the steers are concerned, you can turn off a heifer when she is two years old, fattened on grass, but the steer must be kept until he is past three years. I overheard a neighbor here say that he had a yoke of oxen that would weigh 3,400 pounds, and he could get $300 for them to-day. I wish you would say a little more about this calf raising and what it costs.

Professor WING. The point that the gentleman has brought out is a very good one, and I can match his story with regard to veal, I think, in New York State. One of our neighbors took two calves to market, less than eight weeks old, early last spring — I think in February or March — and brought home a little over $60 for the two. Now, that is the way for bull calves to go, and it is the way for the heifer calf to go, as many as you can spare, but you must bear in mind that you have got to keep up the population some way, and you probably will have to raise some heifer calves. We have made a fairly careful study of raising heifers for several years. It costs us about $15 to raise a heifer calf to five or six months of age. Then we have to pasture her up to two years of age before she comes into production. Now, in regard to the producing cow. The cow will pay for herself, if she is worth raising at all, after she is two years old. You get a profit from her — should begin to get a profit from her — as soon as she is four years old by the milk she produces. If you keep her until she is eight years old she begins then to take on flesh rapidly. Then is the time to get rid of her. Then what you get for that cow will bring up the heifer calf until she is two years old. So if the heifer calf was worth $30 when it was eight weeks old for beef, why we have got to carry her along, — a certain percentage of them, — enough to keep us going, because we have got to make that investment. But we should have a cow so good, like one of the dairy Shorthorns, that she will be worth for beef, at eight years old, enough to pay for replacing her with a two-year-old heifer in your herd, and that two-year-old heifer should again be better than her dam was.

Mr. BARNARD. Can't the pastures back on our hills be brought up and improved faster under this method of keeping the dual-purpose animal and raising a few calves every year,

— can't we improve those pastures much faster than we would by simply keeping cows, and buying our cows on the market and letting them go, just keeping them in the pasture during the day and in the barn at night?

Professor Wing. It seems to me that that is a question that can't be answered categorically yes or no. It is for each man to discover. That is your business, — to study your own conditions as to whether you can do as you indicate. Now, I think that there are very many localities in which that very thing can be done. Raise more animals than you are raising; utilize your rougher land, bearing in mind all the while that you have got to put something into that land and so build it up; and keep a large drove of animals other than strictly dairy cows. But it may or may not be so, according to individual circumstances. That is what the Englishman is doing; that is what the Hollander is doing to some extent, — not so much, perhaps, as the Englishman. I would like to say one word further in regard to the question you raise in regard to the dual-purpose animal, and put myself, perhaps, in a little better light. I don't believe that a dual-purpose animal will compete in quality or economical production of beef with a special-purpose beef-producing breed. I don't believe that a dual-purpose animal will compete with a well-bred dairy cow for the sole production of milk or milk products; but I do think there is abundant room for an animal to be produced that will produce profitably both milk and beef.

I don't believe, take it as it runs, New England soil is any less productive, or has any less capacity, than it had when the pilgrims landed on Plymouth Rock, and I think that the time is coming back when New England farmers are more and more going to be as their ancestors were, — self-contained, self-reliant, and are going to produce more of their food products. They are going to diversify their industries. It is a diversified country. It lends itself to diversified production, — some mutton, some beef, some pork, some chickens, lots of fruits and plenty of vegetables.

Professor Foord. Professor Wing called our attention to the fact that many of our hill farms are better adapted for sheep than anything else. He has also called our attention to the fact that we can make money feeding our corn and grass to beef cattle, even though it does take 23 pounds of feed to make 1 pound of beef. I think this audience wants to take account of the fact that we have in our midst three kinds of animals with special privileges, and they are the dog, the cat and the deer, and there is no reason for it. We have had dogs drive sheep into the barn and lacerate them. I know there is a difference of opinion as to whether the dogs do drive out the sheep industry, but I think there is no reason why the dog and the cat and the deer should be specially privileged animals. And there is no reason why a man who owns a dog or cat or deer should not be obliged to keep it under subjection the same as he does the horse or cow or sheep. And I think we ought to think that over and perhaps put them all under the same restrictions.

Professor WING. I am glad Professor Foord brought up this matter of the dog, because I was sure it would come up. I didn't mention it before because I preferred it should come from the audience. I have perhaps some radical views on both sides of the dog question. I have no use whatever for a worthless dog, and 99 dogs out of 100 are worthless in my opinion. And I thoroughly agree with what Professor Foord says, that there is no logical reason why the dog should be a privileged animal any more than a cow. If the dog can run loose in the highway, I claim the same privilege for my cow, — let her go where she wants to. Then, so far as keeping sheep is concerned, I don't believe that the dog excuse is a valid one for failure to keep sheep, for two reasons, one based on my own experience, or on an experience that came very close to me. My father-in-law was a farmer in western New York and kept sheep in a dog-infested region. He always kept sheep and a good flock of sheep. He kept a loaded shotgun behind the door, and it was very seldom that a strange dog crossed that farm in daylight and got clear across, law or no law. They were usually buried quietly under an apple tree and helped to produce fruit, and did more good that way than ever before, and nothing was said about it. Then, too, there is another factor in sheep-producing, so far as dogs are concerned. Modern wire fencing is a fairly safe protection against dogs, and it is fairly cheap. Now, you can fence a sheep pasture somewhere on your farm and be reasonably secure against dogs. I should still keep the shotgun as a safety precaution in connection with it. So I say that the question presents itself to me from both sides. I don't believe the danger from dogs is a valid excuse against sheep-keeping for any man who really wants to keep sheep. On the other hand, I don't believe the dog is entitled to the privileges he has, and if I was keeping sheep I would shoot every dog I found on my premises, no matter where he came from.

Mr. FAUNCE. I come from the territory first occupied by the settlers here. I own lands that were plowed and planted by those early settlers. When they came here there were no cattle. There was great anxiety among them to get cattle here, to increase the number. The facilities for bringing them across the ocean were very slender. In the early days, as you know, the vessels in which they came had not the accommodations that now exist. Dr. Fuller, among the earliest settlers, was very anxious, among the rest, to increase the number of cattle. The cattle then were largely of the little black variety. I think I saw one of the descendants out at the Agricultural Farm a year or two ago. Dr. Fuller probably made the first will that ever was on record, and — I state this simply to illustrate the anxiety and his desire — he says in his will, "I give to the First Church in Plymouth my black heifer on condition that they shall raise all her heifer calves." At the same time he says, "That which Roger Williams doth owe me for physic I do freely forgive him." That shows, you see, the desire for the cattle was above any monetary interest. Now, they were anxious to increase the cattle, and we ought to be as anxious to increase them. The question is, how; and I have not learned anything to-day that will show me how it can be done; whether they can do as I have done, — substitute the oxen upon our farms instead of the horses, — and in that way increase the cattle. I am not sure whether it can be done or not successfully; at any rate, that is my project at the present time.

QUESTION. Do I understand that you advocate raising all dairy cattle, or the dual-purpose cow, or some dairy cattle and some beef cattle on the same farm? Another question: will a farmer ever be able to handle a quarter-section of land in New England as profitably as he can a quarter-section in the middle west?

Professor WING. I don't believe I quite understand you. If you raise the question whether you could farm a quarter-section — 160 acres — in New England as profitably as you could 160 acres in the middle west, that is a question that there might be a great deal of discussion about, and I don't believe you would be satisfied even then. All I can say would be this: taking the average of what we call the middle States — Ohio, Indiana, Illinois, Missouri, Iowa, parts of Minnesota and Wisconsin — the productive fertility of the soil will average greater per acre than it will in New England. But as to whether you can farm more profitably will depend upon the investment in the land, the business capacity of the man with respect to following the course of the markets and systems of farming, and then the actual ability of the farmer himself. Now, those are factors that no person can determine, and might be answered either in the negative or in the affirmative. Some men will make more on 160 acres in New England than other men will make in the middle west, and *vice versa;* but as to what the same man would make in both places would depend on his capacity to adapt himself to circumstances.

QUESTION. Would you recommend crossing Holsteins with Shorthorns in order to get a dual-purpose animal?

Professor WING. No, I would not recommend crossing any breeds. There is no question but what you may develop strains of Holsteins large enough framed to take on flesh to answer the purpose. You may do it even in Jerseys and Guernseys. But don't start out with the idea that in your lifetime you are going to make a combination that is better than the two separate. If you had the skill and the capacity and the money that men like Thomas Bates and Robert Batewell had you might leave something for your posterity. It is a worthy object, but don't go into it in the present day of our improved breeds with the idea that you are going to do much for yourself.

Meeting in Chamber of Commerce Building.

While Professor Wing was speaking on beef production, a session for women was held in the Chamber of Commerce Building. Mr. Henry M. Howard of Newton presided, and introduced Miss Laura Comstock of the Massachusetts Agricultural College, who spoke on "Household Accounting."

HOUSEHOLD ACCOUNTING.

MISS LAURA COMSTOCK, EXTENSION PROFESSOR OF HOME ECONOMICS, MASSACHUSETTS AGRICULTURAL COLLEGE, AMHERST, MASSACHUSETTS.

Mrs. Lucas[1] has said that "in olden times women thought and thought and thought before they spent, — now women often spend and then think and think and think." If this is true, how may a change be brought about? By convincing the homemakers of their responsibility with regard to the expenditure of funds; by showing them that homemaking has in it all the elemental features of a true business, and that to succeed in it requires the best of training.

Contrast the present-day housekeeping with that of fifty years ago. Have the keepers of the home made as great an advance in their business as the farmer, for instance, has in his? If not, how may this be remedied?

Organizing ability is one of the requisites. The routine of housework in the least time and with the least energy can be accomplished only after much study, but that is not all; the responsibility of spending much of the income also rests upon the housewife. This is one of her greatest problems. To succeed she must view the question in all of its phases before spending a dollar. In other words, a budget should be made and lived up to as nearly as possible.

When a home is started there should be the utmost frankness in the discussion of the standards to be maintained in that home. It is taken for granted that there will be certain ideals. These ideals will undoubtedly change from year to year, — grow higher as the lives of the homemakers enlarge. These changes will affect the way in which the income is spent. More money will be devoted to one purpose and less to another. Certain standards will be felt to be absolutely necessary to the home life. True co-operation must exist from the first, so that no differences may later arise to shatter these ideals. When both husband and wife fully realize what they wish to express by their home, and know the yearly amount of money at their disposal, then let them discuss how to spend that income to the best advantage. To have clearly in mind what each particular purchase will give to the home, to know that it supplies a real need, will bring true contentment. It will satisfy not only the individual but the group which constitutes the family. The right idea of use will prevent worthless buying. How may this be accomplished? Not only by making a budget but by keeping a strict account of all expenditures. Mrs. Richards has said that "the great educational value of knowing how our money is spent cannot be overestimated."

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[1] Lucas, Bertha J. R., "The Woman who spends," p. 12.

BUDGETS.

First, then, the budget must be considered. If a home is just being established, then recourse must be had to the budgets of families living in similar circumstances. If it be a family of some years' standing, and no accounts have been kept, the budgets of other groups must be consulted; but in addition some help may be given by an estimate of the outgo of previous years.

In dividing the income the ideals of the family will modify the amounts suggested for each column. In the budgets considered the average American family will be taken as the unit, two adults and three children under working age, or the equivalent of four adults.

Suggested Budgets.[1]

FAMILY INCOME.	PERCENTAGE FOR —				
	Food.	Rent.	Operating Expenses (Wages, Fuel, Light, etc.).	Clothes.	Higher Life (Books, Travel, Church, Charity, Savings, Insurance).
Two adults and two or three children (equal to four adults): —					
Any income (ideal division), . .	25	20±	15±	15±	25
$2,000 to $4,000, ...	25	20±	15±	20±	20
$800 to $1,000, ...	30	20	10	15	25
$500 to $800, ...	45	15	10	10	20
Under $500, ...	60	15	5	10	10

[1] Richards, Ellen H., "The Cost of Living," 1905, published by J. Wiley & Sons.

In the "ideal division" it will be noted that 25 per cent is spent for food; 20 per cent plus or minus for rent; 15 per cent plus or minus for operating expenses; 15 per cent plus or minus for clothes; and 25 per cent for the higher life.

FOOD.

There are five divisions made in dividing the income. Food is first, for without that life cannot be maintained no matter what else may be possessed. This is absolutely essential. It may not be the kind desired, but if it contains proper nutriment the body may maintain its working efficiency. Some of the cheapest foods contain the various nutrients in available form, so that economy along this line is entirely possible. A knowledge of food values will enable one to regulate this column to a nicety, and still the family be nourished in proper form. To buy out of season always adds much to the cost and seldom adds materially to the food value. Some of the most expensive foods, such as meats, have substitutes. If vegetables are not strictly fresh they may have deteriorated decidedly and therefore be expensive. One must be well trained in the business of buying and have a knowledge of food values in order to keep this item within bounds.

Many inexperienced housekeepers order too much or prepare too much. If these left-overs are not properly utilized there will be a leak. Look well to the garbage pail. Keep it free from foodstuffs that can in any way be used. You know that as a class American cooks are wasteful, and that our more thrifty relatives across the seas know much better than we the value of left-overs. Is it true that a French family could be fed on what an American family throws away?

Food must, as before stated, contain the proper nutriment. It must be clean. The standard of cleanliness is constantly rising; greater demands are placed on the producers, with a resulting rise in prices. It must be properly cooked, otherwise a perfect food might be spoiled for use. It must look attractive. There necessarily must be variety; but not so much as some people think. In this respect we may be able to save on the cost of food. Twenty-five per cent is the proportion set aside for this necessity.

It will be noted in the budgets that the smaller the income the higher the percentage spent for food. A man earning but $500 spends 60 per cent, or $300, of his income to supply the amount of food necessary. If he has a garden or gets some produce from the farm, the percentage spent for food may seem abnormally low, but these factors must be considered.

Rent or Ownership.

The next item to be considered in Mrs. Richards' "Suggested Budgets" is that of rent or ownership. In securing a dwelling in which to house one's family, many factors must be taken into consideration. These will directly affect the percentage of the income devoted to this end. The wise person is one who secures a house that is not lacking in any sanitary requirement. The nature of the soil and the ease with which the plot may be drained should be two determining factors. Light should be abundant, and a free circulation of air made possible. A good neighborhood should be selected, for the moral side has to be considered in the selection of a home. Many a small house in an unpretentious street or neighborhood may measure up to all requirements in sanitation, outlook, arrangement of rooms and moral tone. There is no question that owning a home helps to develop character. A greater pride in the homestead is usually taken, a responsibility for the general condition of things in its immediate neighborhood, and this interest widens many times into responsibility for the affairs of the community. As the social part of life is of importance this must be reckoned with when considering the question of owning or renting a home.

The amount set aside for rent is about 20 per cent. Not more than 25 per cent of the income should be used unless heat is included, as in apartments in a town or city.

Operating Expenses.

The home having been secured, the question arises as to the maintenance of the same. No house should ever be considered without carefully estimating the fuel required to heat it comfortably, the kind of lighting system afforded and cost of maintenance, and cost of keeping the house clean and in repair. The matter of keeping the house clean should be looked into more carefully than it usually is, as it means pleasure or pain to the housewife.

Aside from these points which help definitely in the choice of a house there are such items as express, postage, car fares (incidental), water tax, and other small expenditures which in the aggregate amount to a surprising sum. It is in operating the house that small leakages occur. As a rule, details are neglected and the bills run up. A strict account kept of all disbursements in this department will many times reveal interesting means of saving without crippling efficiency.

Fifteen per cent plus or minus is indicated in the ideal division, and in all incomes of $1,000 or over it is practically covered by that amount.

CLOTHES.

The same per cent is indicated for this department as for operating expenses. Certain budgets indicate that more has been spent than the 15 per cent, but these are individual cases. One should buy with a long plan. By this is meant that one winter certain pieces of wearing apparel could be bought, such as a suit, two suits of heavy underwear; the second winter a coat, and in place of the underwear, stockings and shoes. One should be a good judge of textiles and should have in mind the physical need and also the æsthetic need. It is a duty of all mankind to look as well as possible. Neat clothes which are well made, simple in outline and of good wearing material are no more expensive in the long run than those which are untidy in appearance, extreme in style and unsuited to the wearer. Clothes should have a distinctive air. They should look as if they were meant for the individual wearing them.

HIGHER LIFE.

Twenty-five per cent in an ideal distribution of funds is set aside for the intellectual and emotional life, — to that which contributes so much to our truest enjoyment. In this list is included sums given to church or philanthropy, savings, which may include insurance and investments, education, travel and recreation. Papers and magazines, books, subscriptions to concerts and the like could be credited to education.

The matter of cultivating a habit of saving and putting aside definite sums each week, month or year, depending on the manner in which the income is received, should be emphasized. Whenever the income will permit this should be regularly done. The habit of saving is worth everything to young people, and will prepare not only for the "rainy" day, but for the sunshiny one as well.

ACCOUNTS.

After the question of the proper distribution of the income has been thoroughly discussed, and definite sums apportioned for different purposes, the next thing is to decide on the best way to keep accounts. He would be a poor business man who did not know where his money went after he had earned it. How can one tell where it is best to retrench, if that becomes necessary? Where would it be best to appropriate more in order to lead most efficient lives? Is the doctor receiving a goodly percentage of the income for keeping the homemaker in fit physical condition, while little if any money is spent for help with the housework? Accurate accounts, if carefully studied, reveal much of an interesting nature. Comparisons by months and by years will prove profitable by showing the wisdom or error of the method of expenditure.

What is the best method of keeping household accounts? That method which will give the least trouble, take the least time, and show daily, monthly and yearly expenditures. An elaborate "system" has killed many an honest attempt to keep accounts. Keep them in such a way that a balance can be made at any time between receipts and expenses. Items should be so listed that there will be no difficulty in seeing how much is spent for food, how much for clothing or other purposes.

The account keeper must decide how minutely itemized the record shall be, *e.g.*, are there to be subdivisions under food, such as dry groceries, vegetables, canned goods, meat; under clothes are the individual members to have separate accounts. Operating expenses may profitably have subdivisions such as fuel, lighting, laundry, outside help. The extra time taken to place expenses in the right column will be little and the returns will be great. Above all, make the record fit the family needs. If five columns would show all that was desired as to better ways of expending the income the following year, have five. If seven are needed, have seven. Head them to make them most useful to your family.

The following explanations are given to suggest ways of keeping accounts that are workable: —

Envelope System.

The simplest way of keeping accounts is by the envelope system. This plan, however, seems only advisable when one's income is not much above $1,000 a year, and is received at stated times. Envelopes are marked and the apportioned sum placed inside. When any money is taken the date and amount should be recorded on a slip of paper and placed within. The account should be balanced weekly or monthly, depending upon when the appropriation is renewed. If any money is borrowed from one envelope for another careful record should be kept of it.

Following this method means that many times more money is kept about than is safe or desirable. Also, when money is borrowed from one account for another and not credited there is confusion in balancing accounts.

Note-book System.

An ordinary unruled note book or loose-leaf note book may be used by ruling the pages to suit the divisions of the income; or a family expense book may be bought with printed headings. Two pages should be used for the account. Reference to the specimen pages shown will make plainer the following explanation.

On the extreme left of the first page should be a column for the days of the month. The source of receipts should be noted as well as amounts.

Food has but two divisions, groceries and meat. It seems inadvisable to keep these items in greater detail on such a page. If one wishes to know exactly how much is spent for dry groceries, how much for green groceries, how much for fruit, these accounts can be easily kept by retaining grocers' slips, and entering amounts on a separate page; or by using a small pass book, where items are entered, prices noted and the totals

Expense Account. Month of 19 .

Date.	Receipts.		Food.		House Ownership.			Operating Expenses.				
	Source.	Amount.	Groceries.	Meat.	Interest on Value.	Taxes, Insurance.	Repairs.	Fuel, Light.	Wages.	Stationery, Postage.	Telephone.	Express, Freight, Car Fare.
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27,												
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29,												
30,												
31,												
Total,												

Monthly total receipts, $__________

Expense Account. Month of 19 .

DATE.	CLOTHES.	HIGHER LIFE.									Daily Total Expenses.
		Church, Philanthropy.	Books, Magazines, Papers.	Lectures, Theaters.	Travel, Societies.	Savings.	Furniture, Household Appliances.	Physician, Dentist.			
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29,											
30,											
31,											
Total,											

Monthly total expenses, $______________

transferred to a general account book. If the family buys fruits and vegetables out of season it is well to keep careful record of such expenditures, as it is easy to substitute something which will be of equal nutritive value but much cheaper. On the other hand, the itemized account of fruits and vegetables will often show a surprisingly small amount used, and it would be a question worth considering whether more of the income should be used for the purchase of these commodities.

House ownership is indicated in the next division. Interest on the value of the house and the lot is the first subhead. Another includes taxes on house, grounds and gardens; and insurance premiums. There are yearly repairs that should be made and are suggested as a third heading. If car fare has to be paid to and from work, then that too should be reckoned under ownership or rental, as a stated sum must be put by to meet the expenses because of the location of the house.

If a house is rented the headings would be practically the same, — rent would replace interest on value, and taxes would not include the house and land. Many times repairs are made for which the owner does not pay, and these should be noted as repairs as if the property were owned.

Under operating expenses there are five heads; fuel and light, wages, stationery and postage, telephone, express and freight charges and car fare for other than business purposes.

Fuel should include wood, coal, kerosene, alcohol or electricity. If wood is taken from the farm, that item should appear either in the farm records or the household records or both. Kerosene used for the oil stove might be included with the oil for lighting purposes if lamps are used. Alcohol used for a flatiron should be listed under fuels.

Wages should include what is paid regularly to the maid, if one is kept, and the occasional help from outside, *e.g.*, some one to help with the weekly cleaning, laundry work, the cleaning of windows. Laundry may be listed in a separate column if so desired.

The next two subdivisions need no comment, — those of stationery and postage and telephone. The last column indicating car fares means the occasional trips taken by the family and not the regular business trips.

Clothes may well be subdivided according to the members in the family; but it would seem more simple to keep the itemized account on another page in the same book, and record the total expenditures on this sheet.

The last heading, higher life, or, as Mrs. Richards calls it in another place, the "intellectual and emotional" life, receives 25 per cent of the income in the ideal division. This must of necessity be cut down when the income is small, but some allowance must always be made; otherwise the mere feeding, housing and clothing would mean an existence little above the brute stage. Here the divisions will represent what the individual families most enjoy, and the accounts will show whether the expenditures for the things lasting but not material are wisely expended.

Church and philanthropy must surely come in each family record of expense; books, papers and magazines should be found in every home. Library dues should be listed here. Lectures, concerts, theaters, moving pictures are attended frequently and deserve a separate column. Money expended in traveling and vacation expenses form another item under this higher life heading. Savings in the bank, life insurance and stocks and bonds should also be listed. Furniture considered as personal property can be included here, and it is suggested that household appliances be indicated in such a way that the sum yearly spent on these may be seen at a glance. What per cent is spent on such improvements in the home? How much should be spent, taking all things into consideration? Under "physician" and "dentist" should be included all money paid out for physicians, surgeon, oculist, dentist, nurse, medicine and all expenses incurred by sickness. If too large a proportion falls here the matter should be thoughtfully considered to see if the causes cannot be removed.

If other headings are desired space could be used between higher life and daily total expenses.

The daily totals should be calculated and the sums placed in the columns reserved at the extreme right under the caption daily total expenses. At the foot of each column space is left for the totals of each column. The grand total of these totals at the bottom of the two pages should balance with the grand totals of the daily totals. Space is indicated for the monthly total receipts and the monthly total expenses.

In the back part of the account book two duplicate pages should be ruled for a recapitulation by months. When balancing accounts at the close of each month the totals should be carried forward to these pages.

Card System.

The card system is well liked by some people for keeping accounts. In using cards the headings may be the same as those used in a book. Each month the total expenditures should be transferred to a card reserved for monthly totals.

Methods of Payment.

Cash payment is the best method to follow. A checking account in a bank conveniently located is a desirable thing to have and encourages businesslike methods. Grocery and dry goods bills may be allowed to run for a month; but it is not wise to have goods charged for an indefinite time. When cash is paid one cannot spend money that is yet to be earned. When a charge account is kept it is an easy matter to buy, trusting the future will bring money for payment. The installment plan is an expensive one, and should be used only by those finding it impossible to make other arrangements.

It is fitting that this brief discussion of an important subject close with a quotation of Miss Mary S. Snow: "It is meet that women in every part of the land shall seriously study how they will spend the wage so hardly come by on the part of the wage earner, — that wisdom and skill in the spending shall match the earnestness and zeal in the earning."

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AFTERNOON SESSION.

The afternoon session was called to order at 1.30 by Mr. A. Willis Bartlett of Amesbury, who introduced Professor C. H. Eckles of Columbia, Missouri, to speak on "Factors affecting the Economical Production of Milk."

FACTORS AFFECTING ECONOMICAL MILK PRODUCTION.

C. H. ECKLES, PROFESSOR OF DAIRY HUSBANDRY, UNIVERSITY OF MISSOURI, COLUMBIA, MISSOURI.

The day of cheap feed for cattle as well as cheap food for man is past in this country. Never before in the history of the world has such an area of wonderfully fertile and easily tillable land been brought into use within the span of a lifetime as was done in the Mississippi valley during the past century. As a result of this enormous increase in the production of foodstuffs, and the low price which resulted, both the American consumer and the American farmer developed habits which they do not propose to give up without a struggle. The consumer, on the one hand, became accustomed to cheap food, and it was only a few years ago that the standard price of milk in my State was 5 cents per quart. Now, when there are no immense areas of new land to bring into cultivation, and the population is catching up with the production of food, the inevitable result is higher prices for food, and the consumer is certain some one is robbing him because the cost of living has advanced. The consumer does not realize that the farmer who produces the food to-day is making only fair wages, and on the average probably less than he did ten or twenty years ago.

On the other hand, the tendency on the part of the farmer, with cheap feed for his animals, with a soil of great fertility to draw upon, has been to develop most wasteful habits in production. For example, it is only since feed became so high that it is impossible to carry on a dairy business with poor cows, that the milk producer has begun really to give attention to the selection of the individual cow.

It is the necessity of the times that is compelling the adoption of business systems in dairy farming operations. At present a large portion of the United States is in a period of transition from a temporary to a permanent condition of agriculture.

The consumer need not expect cheap food again, neither can the producer expect to continue in business if he does not use methods of keeping down the cost of production which were not thought of a few years ago. It is certainly to be hoped that some means of decreasing the cost of distribution of food products, and especially milk, will be worked out. Unless some means can be found to accomplish this result the consumer must expect to pay more for milk in the future than at present.

Since I am not familiar with New England conditions, I can speak only for my own State, and others similarly located, in saying that the average man who sells market milk to-day is hardly making wages for himself and family, provided everything, including interest on investment, be taken into account. If the average man is doing no better than this, it is evident many are not making even current wages, or savings bank interest on their investment. On the other hand, there are plenty of men who are not only making a good income but in addition are constantly increasing their capital by paying on their farm or buying additional land. I doubt not that a similar variation in income exists among New England farmers supplying your many cities with milk. The farmer below the average, like the cow below the standard, is bound to be eliminated. While I do not believe the price paid the farmer for milk is high enough at present in my section of the country, at the same time I do not believe that the price ever will be raised sufficiently, nor should it be, to allow the slipshod farmers who now rank as below the average to continue in business.

The Conditions in the Middle West.

The eastern farmer is generally inclined to look upon the milk producer in what he calls the west as having great advantages in the way of cheaper feed. In the past this has been probably more of an advantage than it is at present. While the cost of feed is somewhat higher in the eastern States, the market price of milk is also correspondingly better. It is questionable if the farmer who produces market milk in Illinois, Wisconsin or Missouri has conditions any more favorable, taking everything into account, than in the New England States.

It should be kept in mind that the production of milk on the farms in the Mississippi valley is largely a side line to other lines of farming. This is especially true of the cream, which supplies the numerous butter factories which make Minnesota and Iowa the center of the butter producing industry. This cream comes from farms where the owners are, as a rule, producing several articles for market, among which cream is of more or less importance. On these farms the average number of cows milked is about ten. It is almost impossible to estimate correctly the actual cost of keeping cows under these conditions. It is difficult even to estimate the cost of the feed. A considerable portion of their ration consists of roughage in the way of grass, corn silage, and hay, which could not be marketed to advantage, if at all, and the labor of caring for the animals is largely done by members of the family. Under these conditions it is possible to keep a limited number of animals on a farm with very little additional expense. This accounts for the fact that a State like Missouri keeps 750,000 cows, and the farmers consider they are making money in spite of the fact that the average production is only about 4,000 pounds of milk and 160 pounds of butter fat. This is the typical condition in the corn-belt States.

If an attempt were made to keep the same cows under conditions where the feed was purchased at market price and the labor was paid at current rates, these average animals would show not a profit but a loss. At the same time under the conditions existing, they are undoubtedly kept at some profit. The men who produce market milk in my State average a little high in total production per cow, securing on the average between 5,000 and 5,550 pounds of milk.

The following figures give the actual feed consumed and its cost for a year for three Missouri Holstein cows averaging 8,426 pounds of milk, and for three of the same breed averaging 5,709 pounds: —

TABLE 1. — *Three Holstein Cows averaging 8,426 Pounds Milk.*

	Pounds fed.	Value per Ton.	Cost.
Alfalfa hay,	2,216	$14 00	$14 79
Silage,	5,363	3 50	9 39
Corn,	1,808	22 00	19 88
Bran,	904	20 00	9 04
Cottonseed meal,	452	30 00	6 78
Pasture five months,	–	1 50[1]	7 50
	–	–	$67 38

Feed cost per 100 pounds milk, $0.80.
Total value milk, $1.50 per hundredweight, $126.39.

[1] Per month.

TABLE 2. — *Three Holstein Cows averaging 5,709 Pounds Milk.*

	Pounds fed.	Value per Ton.	Cost.
Alfalfa hay,	2,048	$14 00	$14 34
Silage,	4,082	3 50	7 14
Corn,	1,016	22 00	11 18
Bran,	508	20 00	5 08
Cottonseed meal,	254	30 00	3 81
Pasture five months,	–	1 50[1]	7 50
	–	–	$49 05

Feed cost per 100 pounds milk, $0.84.
Total value milk, $1.50 per hundredweight, $85.63.

[1] Per month.

It is seen from these figures that in the State mentioned it cost $60 to $70 to feed a cow that will produce 8,000 to 8,500 pounds of milk, or about 80 cents per hundred pounds. Those averaging 5,709 pounds required about $50 worth of feed, or a cost of 84 cents per hundred. The prices of feed used are about the average prices with us for the past five years, and represent, except in the case of silage, what these feeds could be purchased for on the market. These cows represent ordinary producing animals of their breed. These figures, it should be understood, are based entirely upon actual weights of all the feed and milk produced.

Figures are also given below of the actual feed consumed by three cows having quite a wide range of production. These animals were not on pasture, but received practically the same ration throughout the year.

TABLE 3. — *Amount and Cost of Feed for Three Cows of Different Milk-producing Capacity.*

Holstein, 11,987 Pounds Milk.

	Pounds fed.	Value per Ton.	Cost.
Alfalfa hay,	5,685	$14 00	$39 79
Silage,	7,946	3 50	13 91
Corn,	1,920	22 00	21 12
Bran,	960	20 00	9 60
Cottonseed meal,	480	30 00	7 20
	–	–	$91 62

Feed cost per 100 pounds milk, $0.76.
Total value milk, $1.50 per hundredweight, $179.90.

Ayrshire, 9,169 Pounds Milk.

Alfalfa hay,	4,807	$14 00	$33 65
Silage,	5,550	3 50	9 71
Corn,	1,644	22 00	18 08
Bran,	822	20 00	8 22
Cottonseed meal,	411	30 00	6 17
	–	–	$75 83

Feed cost per 100 pounds milk, $0.83.
Total value milk, $1.50 per hundredweight, $137.53.

Shorthorn, 5,573 Pounds Milk.

Alfalfa hay,	4,023	$14 00	$28 15
Silage,	5,950	3 50	10 41
Corn,	1,140	22 00	12 54
Bran,	570	20 00	5 70
Cottonseed meal,	285	30 00	4 27
	–	–	$61 07

Feed cost per 100 pounds milk, $1.10.
Total value milk, $1.50 per hundredweight, $83.59.

We could give a large number of similar figures of which these are representative. On the basis of our figures, which are based not upon estimates but upon actual records, and which

I believe fairly represent practical conditions, we can make a fair estimate of the cost of feed required for producing milk in my State during the past five years.

TABLE 4. — *Estimated Cost of Feed in Missouri.*

PRODUCTION PER YEAR (POUNDS).	Cost of Feed per Year.	Average Cost per 100 Pounds (Milk).
5,000-6,000,	$50 00-$60 00	$0 85-$1 00
6,000-7,000,	55 00- 65 00	80- 95
8,000-10,000,	65 00- 80 00	75- 85

It is, of course, recognized that the cost of feed, while the largest single item, is only one among several that go to make up the total cost of milk production. It is an exceedingly difficult matter to give a fair estimate of these other factors entering into the cost of milk production. Even as regards feed there is some difficulty, since the cattle make use in part of feed that could not be put on the market, and which therefore can hardly be said to have a market price. In Missouri the production of milk, as stated, is so closely connected with general farming operations that it is practically impossible to separate the labor items. In many cases the milking is done largely by younger members of the family and in that way some income secured for their services, which probably would not be had at all if it were not for having this particular work to do. There are certain items that of course can be estimated with reasonable accuracy, as, for example, the cost of maintaining the herd bull, and the interest on the investment; and it is fairly easy to estimate the depreciation in the value of the cow. I regret that I cannot present some accurately taken figures that would give us definite information for conditions as existing in my State. The best estimate and most complete figures on this subject of the cost of milk production in addition to the feed is found in a bulletin from the New Hampshire Experiment Station by Professor Rasmussen. He estimates the cost of keeping a cow to be $50 per year in addition to the feed.

While the cost of feed is somewhat lower in the Mississippi valley States than in the east, the market price of milk is also lower. A fair estimate of the amount received by farmers in Missouri during the last five years, for milk sold at wholesale to go to the cities, is $1.50 per hundred pounds. The average price for butter fat at creameries has been around 28 cents and in some places probably even less, giving an income of not much over $1 per hundred for milk sold to creameries, exclusive of the value of the skim milk used on the farms for feeding purposes.

There is no question but that a portion of those producing cream for the creamery or milk for cities in Missouri are not making their expenses, that is, either they are not themselves getting current wages or are receiving less than current interest on their investment, or probably both. A large number are really making a small profit, that is, a fair return for their work, while a smaller number are making large profits for the time and money expended. To put it in another way, those who manage their business skillfully are realizing a good market price for their feed at home, and are receiving good pay for their labor and interest on their capital.

Is it possible to produce Milk at a Profit at the Present Prices?

It seems to me that it is fair to raise the question as to whether or not it is possible to produce milk at a profit under present conditions. If it is being done by some, would it not be worth while to study the conditions under which they are doing it? The difficulty in considering the question, as already intimated, is the impossibility of getting a fair estimate as to the various items that contribute toward the expenses of milk production outside of feed. There is plenty of evidence that certain men are producing milk at a profit; at least we have such evidence in my State. We can point to farmers who began twenty years ago with little capital and who have paid for their farms and have a valuable herd of cattle, and who have done so by the production and sale of milk. Unquestionably, similar examples could be cited in other States. Further than that we can refer to actual figures as taken from various sources.

The following two tables, taken from our records, show the amount of feed used and the cost of feeding a Jersey cow for a year, also the production of milk and fat from that ration: —

Table 5. — *Ration fed a High-class Jersey Cow.*

	Pounds fed.	Market Value per Ton.	Cost of Amount fed.
Corn,	1,376	$20 00	$13 76
Bran,	688	23 00	7 91
Oil meal,	344	33 00	5 68
Alfalfa,	2,694	15 00	20 20
Silage,	4,575	3 00	6 86
Pasture four and one-half months,	–	2 00[1]	9 00
	–	–	$63 41

[1] Per month.

Total cost of the feed consumed by this animal was $63.41. Had this animal been capable of producing only 200 pounds of butter fat in a year, this feed bill would certainly look excessive. During the year, however, her production was as follows: —

Table 6. — *Production and Income from High-class Jersey Cow.*

Milk (pounds),	7,940
Fat (pounds),	484

484 pounds fat at 28½ cents equals	$137 94
635 pounds skim milk at 20 cents per hundredweight equals	12 70
	$150 64

The price given per pound of butter fat was the local creamery price during the time this butter fat was produced. The skim milk value is placed at what it sells locally for hog feed. The income from this cow was $150.64 for the year, leaving the calf out of the consideration and figuring on the basis of creamery prices. Granting the accuracy of the estimate by Professor Rasmussen of New Hampshire, that it costs $56 in addition to the feed to keep a cow in milk a year, there still was a margin of $31 after deducting the $119, which would cover all expenses, including labor, interest and depreciation. A cow like this beats any railroad proposition in the country. A railroad is expected to make only good interest on its investment after paying labor charges and depreciation. What railroad can show, as this cow did, a clear profit of one-third the cost price in a year? Take the figures as already given of the Holstein cow producing 11,987 pounds of milk at a feed cost of $91. Had this cow been on pasture, it would have reduced her feed bill several dollars, but at the figures given we can add on the $56 estimated by Professor Rasmussen for other expense, and still, had her milk been sold at the local price of $1.50 a hundredweight, the income would have exceeded the expenditure $33.90.

Whenever figures have been collected regarding the income from herds or from individual cows, the same wide variations in income, as pointed out, have been found. There is one fact, however, that always stands out strikingly, and that is, economical production is found only with high-producing cows. The figures already given, showing the cost of production by cows of different grades, illustrate the facts in this connection clearly. The three Holstein cows producing 8,426 pounds of milk in a year did so at a cost of 80 cents per hundred, with an average income of $126.39, counting milk at $1.50 per hundred pounds. The three Holstein cows producing 5,709 pounds of milk per year cost only $49.05 for feed, but their income was only $85.63. In other words, for $17 additional feed, when given to one of the better cows, $40.76 worth of additional milk was secured. The other items of cost, such as labor, stabling, etc., would be practically the same for both animals. Figures as given for the three individual animals are still more striking. The cow producing 11,987 pounds of milk did so at a cost of $91.62 for feed. The cow producing 5,573 pounds of milk, or practically one-half as much, required feed to the amount of $61.07. At $1.50 per hundred pounds the difference in the income of these two animals would be $96.31 per year. The difference in the cost of feed was $30. The following figures, taken from the bulletin issued by the New Hampshire Experiment Station already mentioned, illustrate the same condition: —

TABLE 7. — *New Hampshire Cow Test Association Records, 203 Cows.*

NUMBER OF COWS.	Production (Pounds).	Cost Feed.	Cost 100 Pounds Milk.	Income above Feed.
8,	Above 10,000	$88 59	$0 81	$106 82
14,	9,000–10,000	88 25	93	79 18
26,	8,000– 9,000	83 46	98	63 86
41,	7,000– 8,000	81 18	1 10	52 11
40,	6,000– 7,000	73 59	1 13	43 65
39,	5,000– 6,000	65 91	1 19	34 56
25,	4,000– 5,000	56 61	1 23	27 20
10,	Under 4,000	57 22	1 86	4 25
Average for all,	7,094	$73 61	$1 04	$49 48

It will be noted that cows producing above 10,000 pounds of milk did so at a feed cost of around 80 cents per hundred pounds. Those producing 5,000 pounds cost about $1.20 per hundred pounds, while those going under 4,000 pounds showed the exceptionally high cost of $1.86 per hundred. Here we have exactly the same point illustrated. A low-producing cow, especially the cow producing less than 5,000 pounds of milk a year, is the animal that shows very high cost of production, and it is only necessary to have a few animals of this kind in the herd before the chances of running the business at a profit are gone.

It should be pointed out that in each case the high-producing animal uses more feed. This is inevitable. There is a good deal of loose thinking and talk concerning this point among dairymen, and especially among others who at times attempt to advise them. It is even stated that it costs as much to keep a poor-producing animal as it does a good one. This is true in regard to certain items of expense, such as stabling, labor, insurance, etc., but it is not true and cannot be true with reference to the feed. The animal that is a large producer must have more feed. And the fact that she is a large producer and requires more feed is the reason she is a more economical producer. In order to make it clear where the economy of production comes in with the high-producing cow, I have prepared the following table: —

TABLE 8. — *Use of Feed by Cows of Different Producing Capacities.*

	For Maintenance (Per Cent).	For Milk (Per Cent).
Cow giving 4,500 pounds of milk, ...	60	40
Cow giving 9,000 pounds of milk, ...	40	60

Under the term maintenance is included the feed necessary to maintain the animal's body. In case of animals producing 4,500 pounds of milk, about 60 per cent of the feed is used to support the body and about 40 per cent is used for producing milk. With the animal that produces 9,000 pounds of milk a year, the condition is reversed. While she uses the same amount of feed for maintenance, she uses 25 per cent more feed than the first, which it will easily be seen gives her twice as much feed available for milk production. This table shows that in general one cow using 25 per cent more feed than another may produce twice as much milk. The economy in the high-producing cow lies in her ability to use a larger amount of feed after enough has been provided for the maintenance of the animal.

This is the simple but entire explanation of the difference in economy of producing milk by different cows. It is not difference in digestion of food, or that one has a power to get something out of her ration that another cannot.

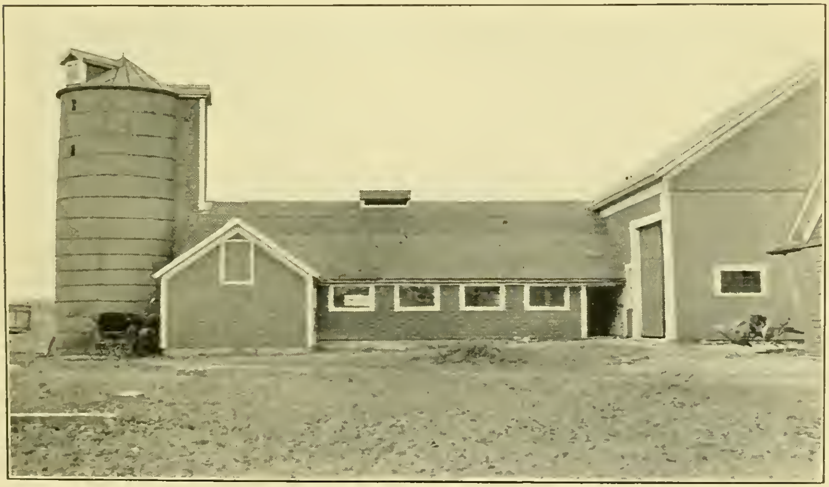
HOW TO GET THE EFFICIENT COW.

It would be interesting, and it might be profitable, if limitation of time did not prevent, to consider in some detail as to how the high-producing cow is to be secured. Time will be taken to discuss only one or two points and those only briefly. The first is that in order to secure profitable cows for the dairy herd, the dairyman must raise them himself. I am fully aware of the situation in regard to the expense of raising a calf where the whole milk is sold, but at the same time there is absolutely no other way for a farmer to improve the quality of his herd. There are herds in my State that have been maintained for twenty years or more entirely by purchase, and these herds to-day, as far as we can find out, are not one bit more productive than was the herd owned by the same man twenty years ago. Absolutely no progress has been made and never will be made until the owner raises his own dairy cows. This will involve, of course, giving closer attention to the matter of breeding. It will not pay to raise a dairy heifer unless the chances are good for her to be a profitable cow when mature, that is to say, she must be given the right inheritance as far as possible in order that the number of cows that will have to be rejected by selection will be reduced to the minimum. After the cow is raised and in milk, the only salvation of the dairyman is to keep records of her production. This may be done to good advantage through the cow-testing association or by the owner himself.

It is not necessary to milk a heifer long to find out if she is a good one or not. Last year I compiled the records of our herd, which are complete for twenty-two years, and I found that in only one case would we have been far wrong had we culled out the inferior cows on their first year's record. It is a mistake to keep a young cow year after year thinking next time she will be a good one. Our rule is that unless there is some good excuse apparent for her poor performance, we condemn a heifer that shows up poorly the first year.

Another question that I might discuss in detail, if I had the time, in this connection, is that of heifer raising and to what extent the manner of raising affects the dairy qualities of animals when mature. In other words, is the inferior or superior cow, from a milking standpoint, born that way, or is she made what she is by the manner of feeding and treatment when young? We have been carrying on investigations along this line for a number of years. Our conclusions so far are, that the dairy qualities of an animal are mostly dependent upon heredity, and that you cannot to any great extent, at least, affect the dairy qualities of the animal by the way she is fed or managed when young. We would, of course, not go so far as to say it is not possible under very abnormal conditions to injure the milk-giving functions by the way she is raised, but it would be necessary to go beyond ordinary practices to get any such effect.

Pure-bred Guernsey cow. An economical dairy machine.



A practical and attractive dairy barn, Hampshire County, Massachusetts.

We are convinced that the milk-giving characteristics are hereditary, but it should be clearly understood that we do not think the amount of milk that a farmer secures from his cows has been taken out of his hands and is to be attributed entirely to the ancestors of his herd. Such is certainly not the case. By the milking qualities of an animal we mean simply her capacity as a milk-producing machine, and in order to get good results from any piece of machinery we must have an efficient operator. So the inherited dairy characteristics of the cow are the first requirement, and the next is that this machine be handled by some one skilled in its management.

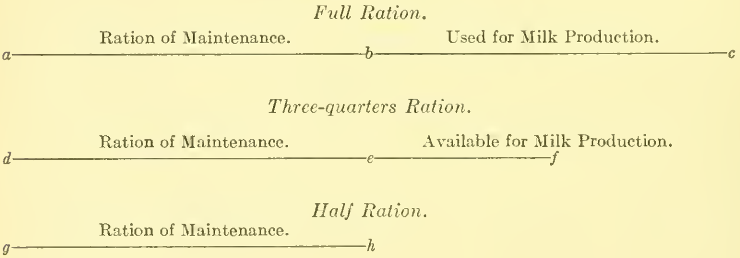
The Feeding Question.

It is not my purpose to discuss the subject of feeding in detail, as I am not familiar with the local conditions and problems, but I desire to take up a few points that I consider of the greatest importance in regard to the fundamental principles of successful feeding. I have already emphasized as best I could the importance of selecting the cow that has the ability to produce large quantities of milk as the starting point for economical production. In Missouri, and I think the same is true in a number of other States, before we can begin to select cows we must first give them an opportunity to make good. If a cow does not receive a sufficient amount of feed, or the ration is unsuitable for producing milk, it is unwise to say she is an inferior producer and sell her. The first thing to do, and the step that must precede the selection of the cow, is to make sure the conditions for production are right. Then if she does not respond, she cannot be sold too quickly.

In the section of the country with which I am familiar, the most common mistake made in feeding cows is not to give them enough. Many of the farmers are more accustomed to feeding steers and hogs than they are to feeding dairy cows. While they recognize that to fatten steers economically the animals must have all the feed they will eat, they do not understand that exactly the same thing holds with a dairy cow. If I see the proposition correctly, you cannot afford to keep cows that are not well fed. It may be that you cannot afford to keep the cows you have at all, but certainly you cannot afford to keep them without using what capacity they have to produce milk.

The dairy cow in a way may be looked upon as a milk-producing machine or factory, and like all factories there is a certain amount of fixed charges that have to be met. With a cow of fair-producing capacity, about one-half her feed is used to maintain the functions of the body without returning anything in the way of product. It is the second half of her ration that is used in producing milk. That is, if it costs us $70 to feed a certain cow in milk, about $35 of this sum is used to keep the cow alive. That is fixed charges or the ration of maintenance. This ration of maintenance is practically the same whether the cow be a heavy producer or a low producer, as already pointed out. The high-producing cow is simply one that has a big capacity for using feed above what it costs to maintain herself. The proper feeding of cows in regard to amount is illustrated in the table which follows: —

Table 9. — *Rations.*



The lines from *a* to *c* represent the ration for a heavy-producing cow, which is the one most liable to be underfed. The first half, from *a* to *b*, represents the amount of feed required to maintain the animal's body. The second half, from *b* to *c*, represents the portion of the feed used for the production of milk. In this case there is no fat being produced on the animal's body and the cow is supposed to have such dairy qualities that she uses all the feed she can digest for milk production.

The line below represents what would happen if the feed of this animal is reduced one-fourth. The ration of maintenance remains practically the same as in the first case. The amount represented by the line *d* to *e* is the amount required to maintain the animal's body, which is the same quantity as in the first case; however, the cut of one-fourth in the ration will be seen to come entirely on that available for milk production and reduces that amount one-half.

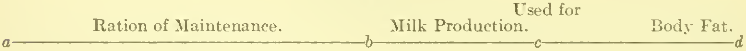
Suppose the ration of such a cow to be still further reduced to one-half of the full ration, or that required for maintenance alone, as represented by the third line, In this case the cutting down of the ration one-half would remove all available feed for milk production. However, the animal would not cease producing milk at once. This is a point of great importance in feeding cows, and a lack of such knowledge leads to serious errors in feeding. The milk-producing function is so strong that the cow will continue to produce milk for some time, even when the feed is insufficient, utilizing the reserve material which has been accumulated in the body in the past. This always happens in the case of a heavy-milking cow during the first few weeks after the birth of a calf. At this time it is not generally possible, and not desirable on account of the condition of the animal, to feed her heavily enough to supply the nutrients necessary to produce the milk. Even if the feed were offered, the appetite is not usually strong enough to cause the necessary amount of feed to be taken to prevent loss in weight. As a rule, all heavy-milking cows decline in weight for the first two or three weeks, and occasionally for ten weeks, after calving, which means that the nutrients used for milk production have been in excess of the feed supplied for that purpose. The same thing happens in the case of a cow that is not fed a sufficient ration for the amount of milk she is producing. She may continue to produce considerable milk for a while by drawing on the reserve material of the body, but as soon as this is exhausted, the production of milk must come down to the amount available for this purpose, above the ration of maintenance. When the feed is in excess, the cow begins to store reserve material on her body. If the amount of milk produced by a cow varied directly with the feed, and she did not store up nutrients at one time and draw on reserve materials at another, it would simplify the problem of feeding very much and result in more economical feeding at all times.

How to avoid Overfeeding.

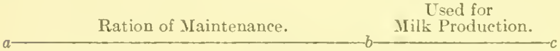
While the statement and illustration given applies to one class of dairy cows, there is another class to which it does not apply, and with which it would lead to a serious mistake in feeding from an economical standpoint. This group includes those of lower productive capacity which are liable to be overfed, especially when they are in the herds of dairymen who realize the necessity of liberal feeding. The proper feeding of this group of animals can perhaps be made clearer by the following illustration: —

Table 10. — *Cow of Lower Productive Capacity liable to be overfed.*

Full Ration.



Economical Ration.



The line *a* to *d* represents the amount of feed that an animal of this class will consume; *a* to *b* represents the ration of maintenance as before. In this case, however, the capacity for making milk is not equal to the capacity of the animal for utilizing feed in excess of that required to maintain the body. The amount which the animal is capable of utilizing for milk production is represented by that portion of the line *b* to *c*, while the animal's appetite is equal to the total line *a* to *d*. This gives a surplus, *c* to *d*, which is not utilized for milk production, but which will be used for storing fat on the animal's body, and we will have the cow gaining in weight while she is producing milk. This gain in weight will be of no service so far as milk production is concerned, except that it is of some value as a reserve material to be drawn upon at some other time when feed is not supplied in sufficient amounts, and it is not economical nor desirable to fatten dairy animals with the expensive feeds which are fed dairy cows. That portion of the feed represented by the line *c* to *d* should be taken from the ration. This means reducing her feed to take off the amount used for storing fat on the body; in other words, feeding her only what she will utilize for milk production. This means feed enough to maintain a practically uniform body weight. In every large herd where the amount fed is not carefully regulated, we find errors made in both these classes. We find the heavy producing cows being underfed, and we find the light producing cows being overfed and allowed to accumulate fat.

Relation of Live Weight to Proper Feeding.

The live weight of a cow is a good index of whether the cow is being fed a proper amount or not, but good judgment must be used in regulating the ration by observing this condition. We must expect that a cow will lose weight in the first few weeks of her milking period, but after this period is past there is no reason why she need to change much in weight for several months, and this is the period when the greater part of the milk production is secured. It will not mean, of course, that the animal should not be allowed to gain in weight during the latter end of the milking period. This is necessary on account of the development of the fœtus, and since it is natural for the animal to carry some fat on her body at calving time.

It does mean, however, that in order to feed a herd of cows economically it will not do to feed them all the same quantity of grain, whether they are giving a gallon of milk a day or whether they are giving four gallons; and it means that when a cow in the middle of her lactation period is putting on weight she is being fed more than she needs, and will give just as much milk if the feed is cut down somewhat. It also means that if a certain animal is losing in weight, sufficient feed is not being given, and if the deficiency is not supplied, it will not be long before the milk production will come down to correspond with the amount of feed available.

Feeding as Individuals.

In connection with this subject of the amount to feed cows, it needs to be pointed out that it is only possible to feed a bunch of cows economically when they are fed as individuals, and not as a herd. A too common practice, even in the otherwise well-conducted herds, is for all animals to be fed the same amount of grain, regardless of the time they have been in milk or the quantity of milk individual cows are producing. Such feeding always lacks economy, as the high-producing cow does not get enough, and, while she may milk very well for a short time, she soon comes down to a lower level, while the lighter producing cow usually gets too much and accumulates fat.

One of the difficult problems which confronts the practical feeder is how to adjust the quantity of feed to meet these individual requirements. It can be done fairly well even in the large herds by observing how much milk the cow is producing, and whether she is gaining or losing in body weight.

Balanced Rations.

In the corn belt next to underfeeding the most common mistake in feeding is giving rations deficient in protein. This comes about from the abundance and relative cheapness of corn, corn silage or corn fodder, and the large amount of timothy hay grown. I assume that in New England, where it is the custom to purchase considerable feed, this error is not so common or serious as with the farmers in the corn belt.

Closely connected with this question is the one of growing legumes on the farm. We are constantly urging the Missouri farmers to grow more alfalfa, cowpea and clover hay. I hope New England dairy farmers already appreciate the importance of this subject and need no urging along this line. In my judgment successful and economical feeding of dairy cows must be based largely upon legume hay and corn silage. With plenty of home-grown alfalfa or clover hay on hand, it is an easy matter to plan a good ration for our cows and at the minimum expense for grain.

Succulent Feed.

In order that cows may do their best it is necessary that succulent feed in some form be provided. In some of the northern sections of our country, and especially in Europe, this desirable part of the ration is supplied in a very satisfactory state in the form of root crops. In the greater part of our country corn silage has taken the place of roots in the ration.

Corn silage supplies the succulent feed so desirable in order to keep the animals in the best possible condition. At the same time in most parts of the United States corn yields more food nutrients per acre than any other crop, with the possible exception of alfalfa in those regions where the latter flourishes.

Missouri has built over 8,000 silos during the past three years, and the progressive dairymen there would not think of doing without one. It will be but a few years until every farmer in the State will be provided with one. The use of silage is also growing with us as a summer feed to help out the pastures. It looks now as if the silo will in time supersede the soiling system almost entirely.

Mixed Feeds.

I presume the sale of mixed feeds is large in the State of Massachusetts, as it is in other places where much feed is sold. While I certainly do not condemn mixed feeds as a whole, I would especially caution every one to be on guard in purchasing them. I see no advantage in selecting them in preference to the straight feedstuffs, like corn, bran or cottonseed meal.

Mixed feeds must of necessity either sell higher than the same quantity of food ingredients in the unmixed form, or the mixed feed must contain some product that could not be sold alone. Every firm making a mixed feed has expenses to meet. They have advertising bills, traveling salesmen, a profit for themselves, and the handling of the feed once or twice in addition. As a matter of fact too often the chief reason for mixing feeds is to sell some product, oat hulls for example, that would not be salable alone. No feed dealer can make a mixture any better or any cheaper than a farmer who is properly informed regarding the feeding problem. In this respect, as well as many others, Massachusetts dairymen will do well to make use of the information supplied by the experiment station at Amherst.

Mr. Bowen. At the price of grain that you gave us there, what would be the amount of milk that would condemn a heifer the first year?

Professor Eckles. The records in our herd show that on the average the two-year-old heifers produced 70 per cent of what they produced as mature cows; the three-year-olds produced 80 per cent, and the four-year-olds approximately 90 per cent of what they did as mature cows. When you try to get an absolute figure it is a difficult matter; it depends upon the breed. A Holstein that did not produce 6,000 pounds of milk as a two-year-old would not be doing very much. A Jersey heifer that did not produce 4,500 pounds would not be doing very much. Unless there is some reasonable excuse for the heifer, you are perfectly safe in selling her if she does not do well in the first place. You can see after the heifer has been milked a month whether she is going to be any good or not. I think the best practice is to milk the heifer for one year, and then decide at the end of that time whether you will keep her or not, and if you decide to sell her keep her until she produces her second calf, because the milk will be good and the calf is as apt to be a good cow, if of a good size, as if the heifer were a better producer. Everything goes to show that in the same breed, cows in the same line of breeding follow the sire rather more strongly than they do the mother.

Mr. TUTTLE. Then, if I understand you, if you had a cow that was not good for much, but her dam and her sisters were good, and she was bred to a good sire, you would not hesitate to raise her calf.

Professor ECKLES. Well, I will tell you the difference in that respect is not as great as we have been inclined to think at times. If she was from a good line of breeding and of a good male, and she was bred to a sire known to produce good animals, I would not hesitate to raise her offspring.

Mr. PORTER. When would you have the heifer freshen; two or three years?

Professor ECKLES. Well, our practice has been, among the smaller breeds, like the Jerseys, to have them come in to milk at twenty-six or twenty-eight months. I do not care to have them come in earlier. We prefer our Holsteins to be fresh at about thirty months. You understand we have four different breeds in our herd, including the Jersey and the larger Holsteins. I have accumulated a large amount of experimental data in the last seven years, while working on this point, that goes to indicate that you can affect at least the size of the animal quite a little; in other words, I have corroborated the belief of practical dairymen that if a cow calves early it tends to make her undersized. We can keep them somewhat smaller and somewhat more refined in appearance if we have them come to milk early. However, our general feeling is that a cow does better if pretty well matured before she comes into milk the first time.

Question. What is the smallest amount of milk a cow must give to be profitable?

Professor Eckles. How much milk must a cow give in order to pay for her keep? Well, that varies so widely it is a pretty difficult matter to answer. Of course, it depends upon the breed, too. I should say that 5,000 pounds, if you had to set one figure, would be as good as any, but I would not want to be satisfied with 5,000 pounds. I think if all the cows in the country produced 5,000 pounds we would be better off. I would want Jerseys to average 5,000, and I would want Holsteins to average 8,000. It is a difficult matter to give any one figure that would be satisfactory. I suppose there are plenty of men in this audience who could give a figure that would be more satisfactory, because they are more familiar with the conditions and what it takes to keep a cow here than I am.

Mr. Towne. I would like to ask this gentleman if in his southern State he can keep a cow longer at pasture than we can in New England, — consequently keep her cheaper. Also I would like to ask this question, although it may not be in his line: Is it practical for farmers who have a good deal of milk to use a milking machine?

Professor Eckles. In regard to the first part of the question, as to the length of pasture season in Missouri as compared with here. The gentleman spoke of Missouri as a southern State. We do not speak of Missouri as a southern State, but a sort of a middle State. But we have not the conditions of the far south there, nor quite the conditions of the north. The pasturage season is unquestionably longer than here. We turn our cattle to pasture ordinarily by the 1st of May, or possibly the last week in April, and if we have an abundance of pasture, so that we allow it to grow up in the fall, we keep them on pasture until the 1st of November. Sometimes we pasture young stock out until Christmas. The conditions are not so much different that way. But haven't we been paying too much attention to pasture, anyway? The general feeling all over the country now is that we have been counting too much on the pasture. Of course, it is very economical from the labor standpoint to have the cattle in the pasture, but to get large production we must have something to help it out as soon as the pasture gets short. So even in the west the pasture proposition is getting to be of less importance than formerly, and lots of the farmers there are commencing to use silage to help out the summer pasture.

The second question the gentleman asked was in regard to the milking machine. Now, I do not know whether I care to make any definite answer in regard to that, but I will answer the gentleman about as I answer the many inquiries we receive on that subject, and that is in this way: I would not want any one to buy a milking machine on my recommendation by any means. I would recommend any one who is interested in milking machines to go and see one in operation and decide for himself, after watching as long as he wanted to, whether he wanted it. My personal feeling is that the milking machine is now a commercial success. I believe if a man has thirty cows or more the milking machine is an entirely practical thing, and I look for the use of the milking machine to be very widely extended in the next few years.

Mr. Wild. I take it that this is a fair, and perhaps more than a fair, representation of the dairymen of Massachusetts. I have for the past three or four years been reading carefully the agricultural papers, especially "Hoard's Dairyman" and the "Rural New Yorker," and others, and have become very much interested in the testing of cows and knowing what they are doing. And I would like it put to a vote in this meeting to-day, how many people there are in the dairy business in Massachusetts who are keeping a record of their dairy production, and with your permission, Mr. Chairman, I would like to ask those who are keeping records to rise so that they can be counted. [Rising vote taken.]

The Chairman. I make it fifty-six.

Mr. Wild. That is very gratifying. It will be, I know, a matter of great encouragement to the Farmers' Bureau of Worcester County to know that there has been a start made in this direction.

Question. I would like to ask one question in regard to this morning's lecture. It is not exactly in keeping with the present topic. As I understood the speaker this morning, he would sell a cow after she was eight years old. I think that would depend something on the production, wouldn't it?

Professor Eckles. My feeling would be, if she were a good cow, not to sell her.

Question. As I understand it, the lecturer advocated selling a cow at eight years if she was fat. He was advocating in that way turning beef into the market.

Mr. Bartlett. I would like to add one point along that line; that is, if a man is raising five or six or a dozen young cattle every year and keeps the heifers he will have something to turn every year, and then of course it would not be profitable for him to turn the best cows, but to turn the ones to somebody else that he did not care for.

Professor Eckles. I would like to ask a question myself of some one. I do not know whom to ask it of. I would like to ask how much milk a cow should produce in the State of Massachusetts to be a profitable animal.

Mr. S. E. Smith. I can't afford to keep a cow that gives less than 6,000 pounds.

Mr. Epps. My milk is sold at 8 cents a quart, and I keep records, and I don't consider that I can keep a cow unless she gives me 8,000 pounds of milk.

Question. I should like to ask that gentleman what kind of cows he keeps. Holsteins, I suppose.

Mr. Epps. No, sir, I have got a herd of mixed-bred cows, some Jersey blood, Guernsey, Holstein, — none of them thoroughbreds. For the grade of my milk I would refer you to the inspector's test. I guarantee it to test from 4 to 5 per cent butter fat. I have no trouble in getting from my herd between 8,000 and 9,000 pounds. I have a small herd of cows, eleven or twelve, and I am not getting rich at that.

ANNUAL MEETING OF THE MASSACHUSETTS DAIRYMEN'S ASSOCIATION.

At the annual meeting of the Massachusetts Dairymen's Association, which followed Professor Eckles' talk, Mr. L. B. Cook, of the United States Department of Agriculture, was introduced and spoke on "The Encouragement of Clean Milk Production."

THE ENCOURAGEMENT OF CLEAN MILK PRODUCTION.

L. B. COOK, MILK SPECIALIST, UNITED STATES DEPARTMENT OF AGRICULTURE, WASHINGTON, DISTRICT OF COLUMBIA.

If the dairy farmers of this country were asked this question, "What can be done to encourage the production of clean milk?" I am sure that nearly all would answer, "Secure better prices and markets for our product." Therefore, the conditions as they exist to-day are these: many dairymen do not receive enough for their product to warrant any extensive changes or outlay, and many dairymen who are paying no particular attention to better milk are receiving the same price for their milk as those who are trying to market a clean, safe product. This state of affairs, one can readily see, does not encourage clean milk production; however, we must work with the facts as they are. If we expect the farmers to produce better milk, we must assist them to receive a reasonable profit for their labor.

In some sections of this country, dairymen state that the price received for milk is not sufficient to warrant their staying in the business. If it were not for the value the cows are to the farm, more dairymen would stop milking them, and take up some other line of agriculture. The question of prices and profit is a problem which we must meet, but one which cannot be quickly solved. While we are adjusting this problem, we must meet the conditions as they exist with many dairymen, and encourage them to the possibilities that are now before them.

The United States census shows that the number of dairy cows per 100 population is slightly decreasing; probably part of this loss is covered by the increased production. The price of milk during a period of years has been increasing slightly, but nothing in proportion to the rise of prices for other foodstuffs. This increase has not been sufficient to meet the increased cost of production.

Improved sanitation means more cost to produce; therefore, when we are working with farmers who are receiving a low price for milk, we must act with reason. No one will deny that in many cases the farmers are receiving little compensation for milking cows; however, I believe with existing prices it is possible for the dairymen of this country to obtain more profit and produce better milk.

It is claimed that only about one-third of the dairy cows in New York State are kept at a profit. If this is true of New York, it is probably true of many other States. As I visit the dairymen of this country, I am impressed with the statements that they make in regard to the amount of milk received per cow. Some dairymen say their cows are averaging about one gallon each, while others say theirs give three. Why this difference? There are several things that might assist in this condition of affairs, yet I believe it is principally accounted for by the difference in cows. A profitable cow costs little more to keep than an unprofitable one; yet farmer after farmer is keeping these scrub cows. It is also a question of the dairyman not really knowing which are his profitable cows and which the boarders. Too many think they have no time for the Babcock test and the scales. If dairymen are to produce milk on an economical basis, they must start with better cows. Then they must properly care and feed these cows if best results are to be obtained. Successful dairymen are using silos, growing alfalfa, etc.; therefore other farmers should study these matters.

Again, as one travels over this country, he cannot help being impressed with the many kinds of waste that are continually occurring on our farms. The farm machinery that should last a number of years is allowed to deteriorate rapidly because it is not properly housed and cared for. One of the most valuable assets to the farm, namely, the liquid manure, is allowed to waste by soaking into the ground near the barn. Even the solid manure is thrown under the eaves, and the soluble elements, which are the best forms of plant food, are allowed to be lost. So we might mention loss after loss that is continually occurring on our farms, mainly because of poor management. I can hardly see how the dairyman can expect the consumer to pay for such losses; yet that is really what he wants when he allows these conditions to exist, and cries for better prices.

Now, why is it that these unprofitable practices are continuing? One reason is that no one has told the farmers differently, and here is a real opportunity for the milk inspectors of this country. The inspector should act as an educator to these farmers, and assist them to see their mistakes. I am afraid we inspectors do not spend time enough on the farms and with the farmers, but try to cover too many places in a day.

Dairymen must be shown the value of keeping books. No business firm, with capital equal to the value of a farm, would think of conducting its business without books. Dairymen must know where their losses and gains are, otherwise, at the end of the year, they will not know definitely whether they have gained or lost. In nearly all hearings on the cost of milk production, the farmers have been hampered by lack of definite figures. It is not sufficient merely to say, "Milk costs me more to produce than I get for it." Until dairymen realize this fact, I believe they are going to be hampered in their fight for better prices.

On the other hand, we should encourage the producer by trying to educate the consumer to the value of milk. During these times of high cost of living, it is very opportune that consumers appreciate the food and economic value of milk. I believe that most people should use more milk, and that many do not realize its cheapness as a food, even if it costs 10 cents a quart. It is surprising how quickly consumers are ready to stop using milk, when there is a rise of 1 cent a quart, yet make little complaint when beefsteak rises several cents a pound. Also, they must be educated to the fact that clean, safe milk costs more to produce and therefore they should expect to pay more. Until consumers are willing to pay a reasonable price for milk, and appreciate quality, it is a question in my mind whether the farmers' prices can be increased, and the inspectors accomplish the results they would like.

Milk inspectors in their work must bear in mind that city consumers need and must have milk; therefore their work among the dairymen should be constructive and not destructive.

I believe the ideal inspector has two lines of work to accomplish; one, to protect the consumer, and the other, to assist the milkman.

Inspectors can do much good by assisting the dairyman to keep in touch with the available literature on different phases of dairying. The successful dairyman must be a business man, that is, one who has knowledge and applies it. Our federal, State and college departments are continually publishing literature which should be in the hands of the milk producer, yet it is surprising how few avail themselves of this free information; possibly, they do not know of these bulletins; if not, inspectors should help to keep them informed. I believe no successful dairyman can afford to be without a dairy paper. By reading and studying he becomes encouraged to produce better milk, and will know how to secure more profit from his business.

On the point of producing better milk there is much need of education. Dairymen must be educated to the value of clean milk. Large sums of money are lost annually because good milk is allowed to spoil. It needs to be said with emphasis that it is to the interest of every producer to have the best milk possible; such milk is always worth more than that carelessly produced, for whatever purpose it is to be used.

Our main standard for quality is the bacteria count, yet dairymen as a rule know little about bacteria. How many farmers know what bacteria are, where they come from, and what they do? Possibly, they have heard something about their dangers, but nothing about their value. Much education is needed on the sources of bacteria and how their numbers can be controlled. The bacteria problem, as now impressed on the minds of many dairymen, is a factor of discouragement, and a problem which they do not know how to handle. They need encouragement and education on this subject.

Good, clean, safe milk can be produced with a minimum of expensive equipment. Why not encourage the dairyman to improve quality by asking him to do two or three essential things, rather than discourage him by telling him a multitude of requirements? I believe more energy should be spent on a few essentials, instead of giving the dairyman the idea that it is necessary for him to go to considerable expense in order to produce clean, safe milk.

The less the expense and the smaller the number of requirements we have for the production of clean milk, the quicker results we are going to obtain. We must always bear in mind that the dairyman is in the business to make a profit, and we should assist him to this end. If we can help him to solve some of his financial problems, the question of quality will be easier to handle. For example, the covered pail costs very little more than an open pail, yet the results for clean milk are wonderful. It is claimed that this one factor under ordinary farm conditions will exclude about 90 per cent. of the dirt. The use of the damp cloth takes only a little time, yet it is one of the important factors for clean milk production.

It is encouraging to note that some of the large dairy companies are paying a premium for milk of a high sanitary standard as well as for a fat content. This, surely, should be an incentive for dairymen to produce better milk.

The grading of milk as now done in some cities and one State ought to be a move in the direction of encouraging the farmer to produce better milk. No one ought to be satisfied with his product when it is sold as grade C and at a lower price than grade A or B.

Certified milk, as you all know, sells for more than ordinary milk because it is recognized as something of better quality. It is only a question of a short time when quality in milk must be recognized, the same as with other commodities. We have made some progress already. The problem of encouraging farmers in this manner rests partly on our city milk inspectors, who should act as educators and not entirely as law enforcers. They must put themselves in the dairyman's place, give him their time and thought, then I am sure results will be forthcoming.

Co-operation and a feeling of friendliness and good will should exist between health departments and dairymen. The farmers should be encouraged to feel that the health department and the inspectors are not only for the purpose of protecting the city consumers but also of assisting them.

One way of promoting this good feeling is by holding meetings at some convenient place, like the country schoolhouse. At these meetings the dairymen should be encouraged to feel that it is their meeting, that questions and discussions are expected. Such meetings are being held by the inspectors of some cities, and are a decided success.

Another method of assisting the dairyman is by milk contests in which good prizes are offered. With these contests are usually held meetings that are of value to the dairymen, and in these contests I think more good can be done the contestants if good, practical prizes are offered; for example, give pure-bred stock, covered milk pails or separators. Education should be the main purpose of such contests.

At a recent milk contest, the results of which were based on the average of four samples taken at random from cans as delivered in the city, I had the pleasure of meeting the gentleman who won first prize. In conversation he told me that he was then receiving about 19 cents a gallon for his milk, which was more than was received by any other producer sending to the same dairy company. Later I learned that in the preceding year, which was his first time in a contest, he won a prize and was at that time receiving about 17 cents a gallon for his milk.

His score the first year was 89.4 per cent. and this year 95.8 per cent. This shows that the contest had been of considerable educational value to him and that he had profited financially, not only from the prize money, which amounted to $45, but, also, he received more for his milk throughout the year.

If results are to be accomplished, the inspector must spend considerable time with the dairyman and not hurriedly try to cover his territory. If this is done, it will mean that there must be more inspectors and more money for this work; yet is not this what must be done if results are to be accomplished? And results are what we want.

I do not believe that as good results can be accomplished by force. You might make a dairyman use a covered pail, but if he has to use it against his wishes, he is not apt to use it when the inspector is not there, while on the other hand, if he is educated to the value of the covered pail, he appreciates the necessity for using it regularly.

The dairyman must be encouraged by our assistance. We must take an interest in his views, and help him to overcome his problems. Nearly every farmer can receive more profit from his dairy if he will use business methods; that is, have better cows, practice better breeding, feed wisely, grow alfalfa, use a silo, etc. He can produce better milk by using a covered pail, by wiping the udder with a damp cloth, by more attention to washing and scalding utensils, and by better cooling.

We, as inspectors, should not only call the dairyman's attention to his poor equipment and methods, but should encourage him by offering suggestions as to how he can, with the least expense and trouble, correct his shortcomings.

We do not want these dairymen to go out of business; therefore, we must assist them to more economical practices, so they can derive a better profit from their business; we want also to educate them to the value of clean milk and the essentials necessary to make such a product.

The main milk problem is not what we can get a few dairymen to do, but what we can assist the majority to do. What are we going to do with the tenant farmer, or one who does not have the means to build new barns, etc.? This is the question which we must answer, and I believe it can be accomplished only by education. What we want is clean, safe milk; the poorly equipped farmer can produce this kind of milk if he only knows the essentials necessary. It is a question of encouraging and not discouraging. As a rule there is no surplus milk in our cities; therefore let us work with the idea of encouraging the dairymen to produce more and better milk.

Mr. P. M. Harwood. I presume the speaker has noticed that the State of Massachusetts, through the Dairy Bureau of the State Board of Agriculture, has done work along the line of encouraging clean milk production, and for that purpose prizes have been awarded.

There has been great improvement during the last year in the exhibits. We had nearly 100 more entries this year in the clean milk contest than we had last year, and I think any one who has seen the cottons both in this contest and in the Massachusetts Dairymen's Association contest will agree with me that there has been wonderful improvement. I doubt very much if there is any other State in the Union that can make a better showing of clean milk. Now, the point that is going to be gained from this clean milk work is that the confidence that the consumer has in Massachusetts milk will be greatly strengthened, which will redound to the benefit of the Massachusetts farmer.

Mr. CROCKER. Won't you please tell the audience just how your agents get at these clean cottons for this test?

Mr. HARWOOD. After the entries have closed we send an agent to each contestant. Five cows are milked, and the milk is put into a mixing tank. The agent then thoroughly stirs this milk in the tank, takes a quart of it and runs it through a sediment tester, in the bottom of which is a piece of absorbent cotton. The cotton is then taken out and put in a box which contains the man's number. The same number is put on a card and enclosed in an envelope on the outside of which is the man's name. Now, these are both sealed and returned to the office. The boxes are opened by the judge. After the awards have been made by number the envelopes are opened, the cards taken out, and the name of the contestant ascertained, so you see there is absolutely no chance for favoritism. Now this whole proposition is one of cleanliness. The speaker here to-day said that clean milk could be made under very simple conditions. We are trying to encourage the farmer to do that, and we find that they are doing it more and more, and the difference between the exhibits this year and last show a distinct improvement in twelve months.

THIRD DAY.

The third day's session was called to order at 10 A.M. by Secretary Wheeler, who introduced Mr. Herbert G. Worth of Nantucket as chairman.

ADDRESS OF MR. HERBERT G. WORTH.

Mr. Secretary, Ladies and Gentlemen: The subject this morning is farm accounting. To my mind there is nothing that should interest the farmer any more than farm accounting. The farmer is the most peculiar man, I believe, that is in business to-day. As a rule, he goes about his business in a haphazard manner and never knows where he stands. If any merchant should have the amount of money invested in a business that the farmer has and could not tell at any time where he stood, we would certainly look for failure from such a man. And I believe that many times the failure of the farmer is due to the fact that he does not know what is paying and what is not. But we are in hopes that the farmer can be educated so that he will know just as well as any other business man where he is. And this morning we are to hear a paper read on farm accounting, which I hope will be of great benefit to each of us. I take great pleasure in introducing Miss Charlotte P. Goddard of Saratoga Springs, New York.

SOME EXPERIENCES IN FARM ACCOUNTING.

MISS CHARLOTTE P. GODDARD, SARATOGA, NEW YORK.

It seems to me that no up-to-date farmer in these days would question the value of a good system of bookkeeping; no such farmer, if his farm is bringing him in a good profit, but would be glad to know just where his best profit is, or, in case there is little or no profit, to know where the leakage is. But how to bring it about is often a difficult problem. His day's work is a long one, often twelve, fourteen, or even more hours. He does not feel like sitting down at his desk at the *end* of such a day, and to stop *during* the day is impossible. Oftentimes that sort of work is distasteful to him, which makes it doubly difficult. On the other hand, to employ a bookkeeper is out of the question, not only on account of the expense, but because there would not be enough work to keep one employed all the time. If he is fortunate enough to have a wife or daughter who *can* do this work, and who has the time as well, then his problem is solved; but usually, even though she may be capable of doing the work, she has duties of her own which require all her time. My suggestion, as a solution of this problem, is that several farmers get together, as they are beginning to do in other lines, and employ a bookkeeper co-operatively. For the past three years it has been my great pleasure to serve one community in this capacity, and I know that the people for whom I have been doing this work will agree with me that the plan has worked splendidly.

My work as a co-operative bookkeeper is the result of the fact that several people in one community felt the need of some one with a knowledge of bookkeeping and cost accounting who would come in and handle their accounts, and whom they did not need to employ for the whole time, as each one needed a bookkeeper only a few days of every month. By co-operating in this matter, they arranged with me to do their work, going from one to another in regular rotation. In this way I have been able to give each one all the time necessary for the work, delegating, in each case, to the man in charge, the keeping of such records as must be made daily. Everything in the way of bookkeeping which could wait until my return was left for me to do, — the making out of all bills, the balancing of the books, the analysis of the bills to be paid, the keeping of all permanent records, and so forth. In this way the coming of the bookkeeper became not a burden, but more and more a help.

In order to show you how it is possible to keep up a system of bookkeeping in this way, and how practical it really is, I will endeavor to describe, in a general way, the system which I have used.

Of the records which the farmer himself must keep, the most important is, of course, a cash book. It is imperative that we have a careful record of every item of expense or receipt, large or small, whether a check or a cash transaction. Such records must necessarily be made daily, so that the care of them devolves on the farmer himself. The balancing of this cash book may, however, be left for the bookkeeper. She might even relieve the farmer of the task of balancing his check book, if he did not care to bother with it himself.

Right here let me say that I hope every farmer *does* have a bank account and *does* pay all his bills by check. I have been surprised to find how many people there are who do not make use of such an institution as the bank. I know of a man who had been in business for himself for years, with good success, who is now the efficient manager of a farm, but who says that never, until within a year, did he do business with any bank. He told me that many times he had had several thousand dollars in cash in his home, hidden under rugs, and so forth; and when I asked him what happened on sweeping day, he replied that his wife took good care of it, that none was ever lost. Would any of you think of mowing a ten-acre field of oats with a scythe when there was a good mowing machine in your own barn? Of course not. Neither, I hope, would any of you think of keeping any quantity of money in your home when there is an institution in your own town which can take better care of your money for you than you can yourself.

To return to our accounts. Aside from the cash book there are a few other records which must be kept up daily, in order to give the bookkeeper all the data she needs. Whenever any article of any kind is sold, some record must be made of it. This can best be done by the use of duplicate slips, similar to those used in our grocery and provision stores. By the use of these a carbon copy is made of every slip. One copy goes to the purchaser, the other is kept for the bookkeeper. From all these slips accumulated during the month she makes out the bills. This is a very simple and safe way to keep these items, and the books are very inexpensive.

The farmer ought also to keep some sort of memoranda of all purchases made, so that when the dealer presents his bill at the end of the month, he or the bookkeeper may be able to check up every item of that bill. In most cases he will receive a slip with each purchase, so that he has merely to keep these together carefully.

The milk record, feed record, and labor record, if kept at all, must necessarily be kept from day to day. I shall refer to these in more detail later.

So much for the farmer's part in this bookkeeping. This certainly is not difficult, nor does it require much time, and it is even simpler than it sounds. And the fact that it *is* simple should recommend it to you, for, next to accuracy, it seems to me that simplicity is the most important quality of a system of farm accounting. By simplicity I do not mean that it shall be any less complete than any well-kept set of books anywhere, but it shall be such that any desired fact may be easily available in the books; that there may be the least possible crossing of accounts from one book to another; that the time which the farmer himself must spend on them shall be kept at a minimum; and that, above everything else, the books, at any time, shall be perfectly intelligible to the farmer himself.

Aside from the cash book, which is to be kept by the farmer, two other books, kept entirely by the bookkeeper, will be indispensable. The first is what I have called a bill book, which takes the place of a customer's ledger. When the bills are made out, each one is entered in this bill book before being sent out. The name of the purchaser, with the amount of the bill and the total amount of each sort of article purchased, is all that need be entered. For example, Mrs. Brown purchased goods to the amount of $15, of which $5 was for butter, $4.50 for eggs, $3 for milk and $2.50 for cream. Mrs. Smith's bill amounted to $10, all of which was for butter; and so on down through the list. Besides entering all new bills, any of the preceding months' bills, which may be still unpaid, are also listed, so that this book, then, always shows what the accounts receivable are on the first of each month, and also gives an analysis of each account, so that we have a permanent record of what each bill is for, as well as the amount of it. This is invaluable, in posting from the cash book to the distribution sheets, for it not only shows where all the receipts shall be credited, but shows it in a small space as well. *All* the items of each bill are not entered, for if a customer should desire a second bill, or if, for any reason, we should wish to know what his bill was for, the items are easily found by referring back to the slips from which the original bill was made out.

The second book to which I have referred is the distribution book. This may be considered as the final summing up of all other accounts, — that toward which all other accounts have pointed, for this is the one to which we shall refer whenever we wish to learn how the business of the farm is getting on. By the use of this book it is possible to do away with a general ledger (unless one prefers to keep that also), and for our purpose it is much *more* valuable. The distribution book shows the entire amount of receipts and expenditures for each month, all on one page, and analyzed in such a way that the receipts and expenditures, for any particular part of the farm's work, may be seen at a glance. These sheets are then summarized on a yearly sheet, which shows the gross expenses and receipts for the year in a convenient and comprehensive way. Every item in the cash book, of whatever kind, is entered in the distribution book. This book must, of course, balance exactly with the cash book each month. The receipts are put in in red, in order that they may easily be distinguished from the expenditures, for both receipts and expenditures may, in some cases, be put in one column.

Many items will need to be analyzed before entering, in order to know that every detail of every bill shall be charged to the correct account. For instance, a bill for grain is divided in such a way that whatever was used for the cows is charged to cows; that used for poultry, to poultry; for horses, to horses, etc. For instance, if the farmer will indicate, on the slip which the dealer gives him whenever he buys grain, just which animals he is buying it for, he will not need to trust to his memory to divide up the bill at the end of the month.

A bill for hardware, too, may be partly for tools, partly for repairs to buildings, and partly for some permanent improvement. This bill should be divided accordingly, and so on with the other bills.

The receipts are taken care of in the same way. For instance, if a customer pays a bill — suppose Mrs. Brown pays her $15, that amount is divided between cows and poultry, according to the amount for butter, eggs, milk and cream. These figures are always available in the *bill book.*

I have here a sample page from such a distribution book. (See Fig. 2.) This shows only part of the headings which might be used.

The headings of the distribution sheet will depend on the nature of the farm. If a dairy farm, we would naturally be interested to keep a number of subheadings under cows, such as butter, milk, cream, stock, grain, labor and dairy; while if the cows were a secondary interest, we might need only one or two. If a poultry farm, we would divide up into several headings for the poultry; this, of course, in order to enable us to know at the end of the month, or the year, not only what the net gain for that particular thing was, but also to know in what special branch the greater part of that profit was made.

The question of dividing the labor into the proper accounts is always a difficult one. The greater part of it must necessarily go under the heading of general labor, but as far as possible anything which can be charged to a definite account is so charged. For instance, on a large poultry farm, where one or more men give all the time to the care of the hens, that time is naturally charged to the poultry account. Division of labor may be made quite accurately by the expenditure of a very little time; in fact, only a few moments each day, if a plan similar to that in use at one of the State colleges is employed. A sheet for each man and each team is kept, with a place to show, for each one, just where their work for the day is put in. This is the labor record to which I have already referred. (See Fig. 1.)

It is important, as far as possible, to separate, in everything, the charges for maintenance and general expenses from those for permanent improvements, for we want to be able to analyze our running expenses at the end of the year.

A yearly inventory is indispensable. Without it even the yearly distribution sheet will not show us just where we stand. That sheet might show a balance on the wrong side, but when the inventory is considered, there may be found such an increase over that of the year before as to more than offset the deficit in the account. On the other hand, we might have a good showing on the distribution sheet, which would be greatly reduced by a decrease in the inventory. But taking the two together, we shall be able to make up a statement which will show exactly where we stand.

Other accounts, their nature depending on the type of farm, will be found very helpful. On a poultry farm I would suggest keeping a careful egg record, and even if the number of poultry is small, such a record will be found to be well worth while. Samples of egg record blanks will be found in Figs. 3 and 4.

On a dairy farm a careful record of each cow is invaluable. By keeping a milk record, with which you are all familiar, and a record of the feed given to each cow (which is much more simple than you think, unless you have tried it), the bookkeeper will be able to work out all the other details found on this record, except the per cent of butter fat, for which you will need to make a test each month. (See Figs. 5 and 6.)

You may notice that I have made no account of the labor of taking care of the cow, and while this must be considered, in order to be perfectly fair, it is not shown on the card for this reason: all the other data on the cards are figures which may be accurately determined each month. Then, the question of labor for the whole herd is taken care of on the distribution sheet. So, at the end of the year, if we wish to add to the whole year's record an item for labor, it will not be difficult to work out an average cost per cow for the year. The value of the fertilizer and the selling price or value of her calf are items on the other side which have been omitted for the same reason.

It would be impossible, I think, to work out a system of farm accounting which could be uniform in all cases, for where one farm may require one plan, the next may require quite a different one. The general plan of the system which I have used in my work as bookkeeper is the same, but there are no two places which use just the same sort of records, as the differences in the farms, as well as the preferences of the owners, must be taken into consideration.

To a certain extent it might be said that accounting could be done equally well for a merchant as for a manufacturing concern, for a lawyer as for a farmer, once one has acquired the knowledge of bookkeeping; on the other hand, it seems to me that an accountant will do better work for a merchant if he knows something of a merchant's business than if he knows only figures; in the same way a person who knows nothing about a farm will have more difficulty with a farmer's books than one who does not have to inquire what is meant by such terms as pyrox, silage, balanced rations, butter fat, and so forth. So a bookkeeper who knew something about the business of farming would be more valuable than one who did not. The more he knows about the details of the farm, the better able will he be to analyze the accounts and keep each item in its proper place.

Because a farmer's books should be as simple as possible, it does not necessarily follow that it is a simple thing to keep them. A set of books which are simple and at the same time comprehensive and definite require, perhaps, more time in their first planning and later in the keeping of them, but one is infinitely repaid when any bit of information about the business is wanted, and it *will* be more and more wanted as its advantages are seen. How much better to give a few minutes each day to the books, in order to have them where every bit of information is easily available, than to do without them because we think we have no time, with the result that when we need a certain bit of information we must spend hours, perhaps, looking through papers, bills, books, and so forth, and then not find it, even in the end. I know the plea that you have no time to give to the books, that you cannot afford to hire any one else, that a farmer has no chance until evening for anything of that kind, and then he is too tired, after such a long day's work as his must be. If he is interested in having his books well kept, and if he can co-operate with several others who care to do the same thing, then this plan of a co-operative bookkeeper is, in my opinion, the best solution of his problem. In this way he has the advantage of an accountant who knows, not only accounts in general, but *farm* accounts in particular, and also has that accountant at a reasonable expense.

In every case I have found that the work which I have done on the accounts has stimulated the farmers themselves to a desire to know definitely about the financial side of their venture. Moreover, as they realized more and more the value of the records, they became more anxious to have them complete, and the suggestion to add a new sort of record has frequently come from the owner rather than the bookkeeper.

For instance, when it comes to the question of distribution of labor, the farmer may say, "It is impossible to divide the labor; most of the time of most of the men is general labor; we cannot split up each one's time." So I get from him, as best I can, a general idea of what the different men do, and then wait. By and by he comes to me, perhaps, about two men who, he has previously told me, were putting about all their time on general work. He will say, "You ought not to charge all their time to general labor; it is too much. They are really putting considerable time on that new building. I think we should keep an account of that, in order to charge it to permanent improvement." "Very well," I say. "That is just the sort of thing I want to get hold of." Then I have him start, in the simplest possible way, a daily record of the time of those men.

Of course you will understand that the accounts of the different farms are kept entirely separate. The co-operation simply consists in the group of farmers, each paying part of the bookkeeper's salary. It is not, in any sense, co-operative bookkeeping. The books of each farmer are absolutely distinct and apart from every other, and the business of each farm is kept as confidentially by the bookkeeper as if it were her own. Nothing must ever be carried by her from one place to another.

I hope that I have succeeded in making clear to you just how this plan of a co-operative bookkeeper has been worked out, and how it may be worked out again. If so, I am very glad, and I shall be happy to do anything I can to help any one who is interested to try out this plan for himself.

TERRACE HILL FARM, PETERBORO, NEW HAMPSHIRE.

Work Report of..for..191....

Wages....................

DEPARTMENT OF WORK.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	No. of Hours.	Total.		

FIG. 1.

Old Town Farm, Peterboro, N. H.
Egg Collections.

Month.			House No.
Day.	A.M.	P.M.	Remarks.
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			

Total
No. Birds
Average

Fig. 3.

SAMPLE PAGE OF DISTRIBUTION BOOK.

Gross Expenses $288.50 Net
Gross Receipts $318.49 $29.99

Labor.		Repairs to Buildings.		CATTLE.				Poultry.		Pigs.		Horses.		Tools.		Woodlands and Pastures.		Sundries.	
				Receipts.		Expenses.													
55	00		15	10	00	33	00	21	77	2	00	18	50		30		15		15
90	00	2	00		37		20		35	7	00	4	50	2	00	5	00		10
25	00			3	18	9	80	8	00	5	00								37
2	00			19	50			16	00	10	00					25	00	1	01
3	00			40	00			2	50	2	00							20	00
1	50			21	01			21	60										
	15			17	00			9	00										
45	00			4	17			5	00										
10	10				33														
16	00			11	23														
176	65							54	10	17	00								
71	10							30	12	9	00								
105	55	2	15	126	79	43	00	23	98	8	00	14	00	2	30	19	85	18	37

FIG. 2.

Egg Record for______________191

No. Hens______________

Date.	A.M.	P.M.	Price per Dozen.	
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				
31				
Total				

Fig. 4.

FEED RECORD.

Date______________________191____

NAME OF COW.	Pounds of Mixture.	Pounds of Hay.	Pounds of Silage.	Pounds of Green Feed.	MIXTURE OF GRAIN.	Pounds.	Price per 100 lbs.	

Upland Farm.

Price per lb. of Mixture Cts.

FIG. 5.

Name__________Register Number__________Year__________

Age__________When dry__________When fresh__________When bred__________

	Milk Lbs.	Fat.		Amount of Butter.	Value of Butter.	Value of Skimmed Milk.	Total Return.	Cost of Grain.	Cost of Roughage.	Total Feed Cost.	Profit.	Cost of 1 Lb. Butter.	Remarks.
		Per Cent.	Lbs.										
Jan.													
Feb.													
March													
April													
May													
June													
July													
Aug.													
Sept.													
Oct.													
Nov.													
Dec.													
Total													

Upland Farm.

Disposition of Calf__________

Fig. 6.

Mr. F. A. Russell. There has not been a subject before the Board meeting this year, or any other year since I have been a member of the Board, that has interested me more than this subject which we are dealing with at the present time. As the speaker said in the beginning, we farmers do not know what we are doing; we do not know whether we are making money unless the old sheepskin is full. But I would like to ask the lecturer what amount of business a man would naturally have to do to be justified in hiring a bookkeeper; or, in other words, if a man is doing $10,000 or $15,000 or $25,000 worth of business a year, would he be justified in hiring a bookkeeper, in your estimation?

Miss Goddard. I should think he would.

Mr. Wheeler. Would Miss Goddard please explain how many farmers she thinks a co-operative bookkeeper could take care of? That is, farmers in the ordinary sense of the word. Perhaps she might be able to tell how many she took care of in her New Hampshire experience.

Miss Goddard. I took care of four farmers, and it required only about two weeks of each month, so that I could have taken care of eight very easily.

Mr. Hayden. I would like to ask how much of a bookkeeper's time would be needed to do the bookkeeping of a dairy farm of a hundred head of cattle.

Miss Goddard. I should think a week a month would be sufficient.

Professor J. A. Foord. I want to rise and second the remark of the Chairman about this paper, and say what an excellent paper I think it is. And I want to emphasize one or two points, especially along the lines of the questions already answered. What Miss Goddard said about the wife or daughter, I want to amplify a little and say, get the boy or the girl. I think perhaps the wife has enough to do. But I want to emphasize, gentlemen, the desirability of getting the young men interested in the accounting side of it. My experience is that it is hard work to teach old dogs new tricks, and the older men are not going to take up detailed accounting. But the young men we want to keep on the farm, and we want to show them that farming is profitable, because we know it is if properly conducted, with the best conditions for right living that there are. Now, the way to do that is to show your boy that you are doing it; and if you are not, why not? And I believe there is no better way or cheaper way for you to get your bookkeeping done than to put those children at it. The boy in the high school can just as well keep the accounts Miss Goddard has suggested as anybody, and the girls, I think, within reason. Now, I do not mean to throw any cold water on Miss Goddard's suggestions, because those children will not stay with us always. I think the co-operative scheme is excellent, but I do want to emphasize the desirability of interesting the young people in the business affairs of the farm, because when it comes right down to it that is what they are going out to look for when they look for a position, — the dollars and cents in it. We know that there is no better place than the farm. Now, one other thing I would like to speak of: Miss Goddard spoke of the purchase slip. I have found no simpler way of keeping the records on the college farm than the record made at the time of the happening, because I want to emphasize the fact that the time to make a record is when it happens, whether it is a pail of milk weighed or the sale of a pig, and the man who makes that record should be the man on the spot. Very frequently mistakes will occur that are easily corrected if you can show the original record. They may be rather hard to decipher sometimes if the man happens to be a Polander, but I believe this is an excellent plan. Miss Goddard spoke of the classification of items, speaking of the feed record. I agree very heartily. The time to classify items is when it happens. I haven't found it quite as simple as Miss Goddard said, but anyhow we do what we can along that line. Now, this classification is not so serious. Do not keep too many accounts the first year. Suppose you say this year, "We will keep an account of potatoes and find out what it costs to raise potatoes." I have been working on this accounting matter a good deal, because I believe every man should know what is doing in his business. Keep accounts as Miss Goddard has suggested, with the amount of labor spent in different operations in hours. Keep a general labor account of your men so that you will get the total cost of labor for the year. Now, at the end of the year, in your general labor account, you have got all the expenses of labor, whether for board or salaries, or whatever it is — it is all there. In each account under your cows, under your apples, or under your general crop you have the number of hours of labor; then it is simply a question of dividing the total expense for labor by the total number of hours for the average cost of labor per hour. It seems to me this is the simplest method I have seen. I can only close, Mr. Chairman, by once more commending the excellent paper, and I do hope it will influence more people to keep accounts. Don't be too ambitious. One account run through a year for one kind of crop will be more valuable than half a dozen for four or five or six months.

Mr. Wheeler. My idea in getting Miss Goddard here was not so much to give a general idea of how people could keep books, but with the idea of using a bookkeeper co-operatively. It seems to me that while the Massachusetts farmers may not be able to afford to hire bookkeepers individually, this system of co-operative bookkeeping and a co-operative bookkeeper can be worked out advantageously. I think we lack trained bookkeepers along this line, and I feel sure that just as soon as there is a call for bookkeepers to go around and make the circuit of different farms, this class of bookkeepers will be supplied by the business colleges and the agricultural high schools which are now advertising various trades, — the business and agricultural bookkeeper. I think we are at the present time in need of bookkeepers who can do the sort of work which Miss Goddard has described here to-day.

Mr. Foster. I would like to inquire of the lecturer how small a dairy or farm she knows of that has employed a co-operative bookkeeper.

Miss Goddard. Well, I think none would be too small. I know of a case of a farmer who had four cows and perhaps not more than forty or fifty hens, and other things accordingly. It took me only one day a month to do all the work.

The Chairman. The next number on the program is a lecture on Alfalfa. Now, alfalfa in New England is in its infancy, and yet I believe that every farmer realizes the value of alfalfa and would like to know how he can raise the crop and raise it profitably, and on those points Professor A. D. Cromwell, professor of agriculture and botany, Pennsylvania State Normal School, West Chester, will try and inform us.

ALFALFA FOR NEW ENGLAND.

ARTHUR D. CROMWELL, PROFESSOR OF AGRICULTURE AND BOTANY, STATE NORMAL SCHOOL, WEST CHESTER, PENNSYLVANIA.

Why grow Alfalfa?

Life is a never ending series of adjustments. Of one thing we may be sure and that one thing is change. New England farmers have not always understood or remembered this, and hence at times New England farmers have failed to adjust themselves and their farm practices to the demands of the times. Among the changes that are now upon us are the adjustments that are to be made in farming by growing alfalfa. For as Mr. Ellsworth of Worcester, Massachusetts, has said, "Alfalfa is to be grown on every farm in New England."

Alfalfa will enable those who grow it to produce on each acre from 3 to 5 tons of feed, which is pound for pound equal to thrashed oats or wheat bran. At the same time that the alfalfa raiser produces from 3 to 5 tons of feed, equal pound for pound to thrashed oats, he is growing a plant that is storing, in each acre of his ground, from $25 to $30 worth of nitrogen each year. Then, too, alfalfa roots deeper than other farm crops, and it brings up from the subsoil rich stores of potash and phosphorus. But since alfalfa comes to us from the semi-arid regions, we must not expect it to produce good crops of seed in this humid climate. However, since it is a gift of the desert, we are to understand that when dry seasons come, as come they will, alfalfa growers are to have a crop, and, if anything, a better crop. Alfalfa can stand hard winters. Alfalfa is green a month earlier and a month later than other crops, and hence for a man who is practicing the soiling system, alfalfa offers a crop that can be used about two months more each year. Since it grows through the whole summer, it offers a soiling crop that is available every month from the time it is large enough to cut in the spring until long after hard freezing comes in the fall.

Alfalfa is a lime loving plant. It has 34 per cent of lime in its ash, while clover has but 20 per cent and timothy but 4 per cent. Growing animals, dairy cows and laying hens need lime. They need more lime than we are able to supply in corn and mill feeds; hence alfalfa offers a plant that will supply lime to make bone and milk and eggs.

There is no need for a New England farmer spending a cent for feed unless he is feeding more stock than his given area of land can support. I mean the New England farmer does not need to spend his hard-earned profits for mill feeds in order to get nitrogen or protein. He can grow his protein at home and enrich his soil at the same time. We live at the bottom of an ocean of air that is about 200 miles deep and composed of about four-fifths of nitrogen, and yet our profits are small and our cost of living high because we have to pay so much for protein, which we need in order to get that single element nitrogen. Yet alfalfa, soy beans, Canada peas, vetch and the clovers, including sweet clover, have associated with them on their roots bacteria which cluster together into different shaped but easily observed nodules, and which have the rare power of taking from the air circulating in the soil that element nitrogen. These bacteria gather more nitrogen than they need; they gather enough to feed the plant and to lay up an excess in the soil to feed the corn, potatoes or other crops which follow the alfalfa. The story seems too good to tell. You can have your cake and eat it. But alfalfa is going to make the man who succeeds in growing it master of the situation. The alfalfa grower is going to be the man who can buy the adjoining farm. The alfalfa plant is going to bring back to New England the Berkshire, the Chester White and the Poland China hogs, to help lift the mortgage off the old New England farm. Alfalfa is going to enable the farmer in the east to make more on the small farm than the mid-westerner makes on his larger farm of $200 an acre land. Alfalfa is going to make the New England hen cackle two months longer each year. Alfalfa is going to add materially to the beauty of the New England landscape.

American ingenuity will soon enable some Yankee manufacturers to put onto the market an alfalfa shredded biscuit that will do more than any patent breakfast food or medicine now on the market to make efficient men and women out of our boys and girls. Alfalfa besides putting the kink into the pig's tail while he helps lift the mortgage, besides enabling the old cow to give more milk, the hen to lay more eggs and the boys and girls to be stronger of bone and larger of muscle, besides adding to the beauty of the New England landscape, alfalfa is to add to the contentment and happiness of the people by putting dollars into the farmer's pockets, and thus enabling him to have better homes, to support better schools and churches, and thus fulfill Dean Bailey's four requirements for the real husbandman: "To make a comfortable living; to leave the farm better than he found it; to rear a family carefully and well; to be of service to the community."

How to grow Alfalfa.

To grow alfalfa successfully there are six things, each of which must be very carefully attended to. You may think as others have thought that you can get paying crops of alfalfa by leaving one or more of the six steps undone, but experience will teach you in time that each and every one of the six things must be carefully taken care of. We call these six requisites the six alfalfa secrets, as follows: —

1. Good, well-drained soil.
2. A good, hard seed bed.
3. Plenty of the right kind of lime.
4. Good, acclimated, northern grown seed.
5. Good, abundant soil or seed inoculation.
6. Good harvesting and curing of the hay.

Good Soil.

You will notice that our first requirement is good soil. Alfalfa must have liberal feeding. It is true that alfalfa when once well established will come nearer making its own way, while giving paying crops, than will any other farm crop; yet this fact must be faced, namely, during the first year alfalfa plants are delicate little plants which respond readily to liberal feeding. This means that we get more from the money spent for available nitrogen, potash and phosphorus to put on the ground, which we are to seed to alfalfa, than we get from the money spent for plant food for most other farm crops.

But how is a man to know what to feed his alfalfa plants? My answer is ask your farm bureau agent, if you have one. He should have gathered some valuable information from the experiences of the farmers of your district, and he should have at hand what the experiment stations know as to what alfalfa needs. The next best source of information after your farm bureau, is your experiment station. Write to your experiment station and ask the men there what they know about feeding alfalfa. Your land may not be of the same kind as that on which they have experimented, and hence you may need other help. I can think of no place more valuable for one to come, once a year, than to a gathering like the New England Alfalfa Association meeting, and there compare notes and hear the experiences of farmers who have been growing alfalfa. But when all is said and done you must do a little experimenting on your own farm. Sow different strips on your alfalfa field with different amounts of the different fertilizers and then watch for results. But to start alfalfa you will want to have a rich soil, and you will need to use something like 500 pounds to an acre of a mixture of about 3 per cent of nitrogen, 8 per cent of phosphoric acid and 10 per cent of potash.

Select Well-drained Soil.

Alfalfa comes to us from the semi-arid regions of southern Asia. To be sure it has been grown in Europe for centuries, and in America for some years, yet it shows its desert origin by demanding a well-drained soil. Alfalfa will not live with its feet in the water. It will do well on loose sandy or stony soil. Alfalfa will thrive on a stony hillside so full of rock and so dry that corn will not develop an ear. I know of two pieces on such soil, one has been down for five years and the other for eight. The soil is so dry and sandy that blue grass and plantain, the two worst weed enemies of alfalfa, have not gotten a foothold. Of course a man gets more alfalfa on better ground, but he gets more dollars worth of feed from such a stone patch than he can get from seeding it to any other plant, unless it be sweet clover.

Alfalfa seems to prefer a southern slope. I think that this is explained in part by the fact that southern slopes are dryer in fall and winter. Perhaps the ground is sweeter and does not heave so seriously. Alfalfa can stand more cold than most other plants. After the first year it does not winter kill in a temperature from 20° to 30° below zero. Alfalfa is green a month longer in the fall and a month earlier in the spring. Perhaps the southern slopes are favorable because alfalfa can get a better growth for winter covering in the fall, and an earlier growth in the spring. This does not mean that you cannot grow alfalfa on northern slopes. It does mean that I advise the beginner to start his first patch or two on his southern slopes.

One of the great problems in America is the conservation of the soil on our hillsides. Alfalfa once well seeded may be left on a hillside for ten years; then if plaintain and grass come in, the patch may be plowed up, cultivated for a half year and seeded to alfalfa for another ten years. This makes alfalfa better than orchards for holding the soil on the hillsides.

Low, wet ground is apt to be sour. It will grow alsike clover, timothy, cow peas, red top and corn, for these are more tolerant of acid in the soil. Cow peas, alsike and red top seem to thrive best where the soil is slightly acid. But alfalfa will not grow on sour soil. It winter kills and the bacteria fail to thrive. Some men have used tile drains and have converted low, coastal plain or river bottom soils into the best of alfalfa soils. Alfalfa being a gift of the desert demands a dry, well-drained soil.

Prepare a Good, Clean, Hard Seed Bed.

When we have studied how to grow alfalfa as long and as diligently as we have studied how to grow corn, we shall laugh at the man who gets less than 5 or 6 tons to the acre, and some of you will be getting much more. But when we have learned how to grow alfalfa, we shall have learned that the seed is very, very small, and that for some weeks the little alfalfa plant is a very delicate little thing. That means that it cannot hold its own against many of the weeds. You can kill the weeds by disking and plowing, by cultivating and hoeing before the alfalfa is planted on the ground. But once the alfalfa is planted, you are doomed to partial failure if you have sown the seed on ground infested with weeds. You must sow alfalfa on a clean seed bed in order to succeed well.

The seed bed should be hard. I would hardly expect to succeed with alfalfa if I plowed the ground just before sowing the seed. I would much prefer disking to plowing before seeding. Where alfalfa is seeded in August, following wheat or oats, disking gives better results than plowing. But wo do not disk to save time. We must disk and disk until it takes as much time as it would to plow. However, the disking leaves a hard seed bed underneath, it gives us a garden mulch on top, and it leaves the stubble on the surface to act as a partial shade and to keep the soil from washing. Plowing, especially after a coat of manure or heavy coat of stubble is plowed under, causes the soil to dry out too rapidly and too deeply. Even oats, with a seed much larger than the little alfalfa seed, frequently do better on disked ground than on plowed ground. But if there are weeds, if the ground has been in oats, say, and the oats have been cut early for hay, then the ground may be plowed, the deeper the better, and the weeds thoroughly killed. After the plowing the ground should be rolled, disked and harrowed frequently to germinate and kill all weed seed and to give a good, hard seed bed underneath, with a clean garden mulch on top. Remember that you are seeding the alfalfa for from three to ten years to come, and it pays to do it well. You can easily reduce your alfalfa hay crop 1 to 2 tons for a number of years to come by not preparing a good seed bed. Think of a man's shortening his yield 2 tons of hay, worth $20 per ton, and that for three to ten years to come, and all of this loss to save a day's labor when preparing a seed bed. The seed bed should be clean enough and soft enough to do for an onion bed. It pays to have a clean, hard seed bed.

Apply Plenty of the Right Kind of Lime.

There are a number of things which we have to learn about liming. But of one thing we are certain, no farm crop requires more lime than does alfalfa. This may be because the bacteria which furnish the nitrogen for the alfalfa are very sensitive to sour soil. It may be, and undoubtedly in part is, because the bacteria that should thrive on the alfalfa roots are most easily killed by acids in the soil. However, I believe that there is another reason. The alfalfa plant has 34 per cent of lime in its ash, clover has 20 per cent and timothy has 4 per cent. I believe that we are just beginning to learn our A B C's of lime for animal and plant foods. I believe that when the truth is fully understood, we shall know that one reason why alfalfa is so good for growing animals, for poultry and for dairy cows is because of its high per cent of lime. If this proves to be true, there is no way known to the farmers of to-day by which they may make money faster than to sow lime on the land to feed alfalfa, which in turn is to feed animals and hence return to him in beef or milk, which sells at many times over the cost of the agricultural lime.

There are two materials called lime, and they come to us in three forms. One material is dolomite, which is a magnesian-calcium carbonate. I believe that when we fully understand the lime problem, we shall have learned that the magnesium lime is not to be used for alfalfa. Hall says the English farmers learned years ago that the dolomite is not good for repeated applications. Do not misunderstand me. Magnesian lime will neutralize acids as readily as pure calcium lime, but I do not believe that the neutralization of acids is all that there is to liming for alfalfa, nor do I believe that sweetening the soil is half that there is to liming for alfalfa. I believe that calcium is a very necessary plant food for alfalfa, and hence well worth feeding the plant in abundance.

Lime comes to us in three forms, — caustic or burned, hydrated or slaked and in the form of ground limestone. Only unburned, ground limestone is to be recommended for applying immediately before sowing alfalfa. Burned lime is believed to be injurious to the alfalfa bacteria. Hydrated lime is but little better. Moreover, these forms are hard on the men who handle them, while ground calcium limestone is believed to be beneficial to men, especially men of weak lungs.

Of course where one has to pay freight on a long haul, and where one can apply the burned lime some months preceding the planting of the alfalfa, it may pay to use burned limestone.

Use Good, Acclimated, Northern Grown Seed.

Our people get the best results by using 30 pounds of seed to an acre. That should be too much. There are places where men have used as little as 6 quarts (12 pounds) with timothy and clover. In time the timothy and clover disappeared, the alfalfa survived and made a good stand that yielded three or more tons per acre. Twenty pounds to an acre should be enough, providing we use a disk drill and use good seed. But good seed is hard to get. I fear that the seed houses palm off on the eastern farmers entirely too much of the Asiatic seed. I fear that at times farmers are led to believe that the Turkestan seed is superior. Then, too, I fear that entirely too much southern grown seed finds its way this far north.

Massachusetts requires good seed, from plants that have been grown in the United States for some years and from States as far north as Montana. How can you get it? Well, one way is to have one of your farm bureau agents go west and find a reliable grower and then buy of him. Another way is to find a reliable dealer and then put it up to him to furnish you good seed at a reasonable rate. I found that we could get for the members of our farm bureau good seed at $7.80 per bushel of 60 pounds, and that at a time when other farmers were paying $13 and $15 for the same seed. It strikes me that there is nothing that your State association can do that will help more than to discover among yourselves a member who knows where you can get good seed; then have him arrange so that you can get seed from him or his dealer. We have a form or legal paper which a man may deposit in his local bank with the money for the seed. The form provides that when the seed arrives, the bank pays the bill and that automatically releases the seed to the buyer.

Of course members of this association will not run the risk of planting seed until their farm bureau agent or their State college men have examined and tested their seed. There is too much danger of dodder. After I had examined the seed from one seed house, and had Pennsylvania State College examine it, and had the men in the United States Department of Agriculture at Washington examine it, I found that the seed house had sent a farmer seed in which he might plant thirteen dodder seeds to a square rod. If you once get dodder on your place, you will probably be unable to grow paying crops of alfalfa for five or more years. My advice is to have samples of the seed examined by some one who knows how to examine and test alfalfa seed. But even that does not assure you that it is northern grown seed. Therefore, get seed from a reliable seed man, pay him a reasonable price, but give him to understand that he is to be responsible for the delivery of first-class northern grown, acclimated seed.

Give the Soil or the Seed Abundant Inoculation.

There are two ways to inoculate. One way is to go to a field where alfalfa is being grown and where there are plenty of nodules on the roots and take the soil from there and spread the soil over the field which you intend to sow to alfalfa. There are people who will tell you that 200 or 300 pounds of soil will do. That may be true where you can sift the soil and seed or sow it with a hand seeder, but I think that a man can better afford to use 2 tons than 200 pounds of soil. If I were going to grow alfalfa, I would put in 2 or 4 square rods of ground. I would put this into alfalfa in the spring. I would inoculate it heavily, and then from that patch I would get soil for my field.

For field inoculation I would use the manure spreader. I would go to a piece of ground where the nodules are thick, shovel off about 2 or 3 inches of the surface soil, and then load the spreader with the soil that lies from 3 inches to 15 inches below the surface. Then I would drive to the land which I intended to sow in alfalfa. There I would put the spreader in gear, let it run until the dirt began to pile up near the rear of the spreader, then stop and crank the load to the front and

Alfalfa field at Medfield, Massachusetts.

then go ahead again. When the dirt was again piling near the rear end of the spreader, I would again shovel or crank it back to the front. You will do well to make a big load cover a half acre. But you can give an acre two loads with less labor and bother than you can putter around with 200 pounds, if you have to sift it and use a hand seeder. Three or 4 tons of soil are not too much. The soil should be spread on a cloudy day, and it should be harrowed in at once. I do not need to say that you run the risk of sowing plant diseases. Hence it is necessary to be very cautious to get soil for inoculation from land free of disease.

We have found that the commercial cultures give us better results and cost us less than the soil inoculation. Of course I think both are better than either alone. You can get enough culture for an acre of seed for $2, and you can hardly take a man and team and spread your own soil for less than $2 per acre. The inoculating of the seed is a simple process. The directions that come with each batch of the culture give one ample information as to just what to do to inoculate the seed. We have had good results from the use of the commercial cultures. The United States Department of Agriculture at Washington is very liberal with their cultures, and hence most of you can get the cultures free by asking for enough to inoculate seed for the number of acres which you intend to sow. Again I wish to tell you that I think you should sow something like 4 square rods the spring before you sow your field. Give the seed for the little patch double inoculation. You may sow a few square rods in the corner of some pig or cow lot. What you want is a rich well-manured plot in which you may get the bacteria to grow. You may seed this with a little oats to help keep down the weeds. Mow the oats for hay. Of course you will select some place where you can well spare a few inches of the soil and where the shoveling will not be hard.

Your main crop should be planted in August. This enables you to kill the weed seed. It enables you to get a crop of oat-hay or oat and Canada pea-hay or a crop of early potatoes. Now, if you have your little patch in which you have been growing the bacteria, and if you seed in August, you have your own soil for inoculation. Do not underestimate the importance of inoculation. After the alfalfa is once well started you will get 1 to 2 tons per acre more each season as a result of good, abundant inoculation. But that is little more than half of the story. If you have abundant inoculation, your alfalfa is to gather for you and store in your soil from $20 to $30 worth of nitrogen each year after the first year. This you are to get back in increased yields of potatoes and corn and in richer protein content of corn and grain for years after the alfalfa is plowed under.

You ought to work out a crop rotation by which you can leave your alfalfa down for three or more years. If you leave the alfalfa down for three years, and if you had plenty of bacteria on the roots, you should have land that is at least $50 per acre richer in nitrogen when you plow it up.

Harvesting Alfalfa Hay.

After having grown a crop which is equal pound for pound to thrashed oats or wheat bran, a man can very easily lose much of it by improper handling. He may injure his stand of alfalfa very materially by cutting too early or too late. Alfalfa must be cut when the little sprouts at the crown are well started and are yet not high enough to be cut off by the mowing machine. If mowed too early, they are little delicate, white sprouts that cannot stand the exposure to the bright sunshine and cannot yet make their own food. If cut too late, the plant may have accomplished its natural life work of reproduction and hence die a natural death; or the mowing machine may clip the top buds of each of the stems that were to have made the next cutting. Then, too, if one cuts alfalfa in a humid climate, especially where there is much moisture in the ground, and cuts it in the forenoon, he cuts it when there is most moisture in the stems and leaves. The hay is longer in curing, the bacteria of decay have a longer time to work, and hence the hay is of less value. But if one cuts in the afternoon, when the stems and leaves are wilted, he is able to put up the hay sooner, it is dryer and richer, and in every way better. Of course this does not offer so favorable a labor schedule, but alfalfa hay is rich enough in food elements so that some extra labor can well be used in harvesting it.

But the man who does not understand alfalfa will suffer the greatest loss, because he does not use the hay caps. The alfalfa leaf is the richest part of the plant. Horses do not like leaves so well, but cattle and chickens like them better. But the leaves are very readily shattered off unless the hay is cured under the hay caps. Some people make the mistake of having caps that are too small. The caps should be at least 50 by 50 inches. The corners may be fastened with weights or wire pins. Weights are made by filling small plant pots with cement into which has been placed a wire loop or hook. Wire pins are most pleasing to some. The pins are made by cutting a good strong wire into foot lengths and then bending a hook or loop at one end. The pin is jabbed into the hay under the cap and thus holds the corners down and the cap on.

SUMMARY.

WHY GROW ALFALFA?

1. Alfalfa is pound for pound equal to thrashed oats.
2. It pays better to grow alfalfa than to buy mill feeds.
3. Alfalfa requires less work than is required to grow other farm crops.
4. Growing animals, hens and dairy cows need lime, and alfalfa furnishes most lime.
5. Alfalfa is the most drought resistant farm crop.
6. Alfalfa gives us most protein per acre.
7. Alfalfa does most to improve the soil because (*a*) it roots deepest; (*b*) it gathers and stores in the soil most nitrogen.

HOW TO GROW ALFALFA.

Six alfalfa secrets: —

1. Good, well-drained soil.
2. A good, rich, hard seed bed.
3. Plenty of the right kind of lime.
4. Good, acclimated, northern grown seed.
5. Good, abundant soil or seed inoculation.
6. Cut at the right time and cure in the right way.

A Dozen Alfalfa Don'ts.

1. Don't sow on weedy soil.
2. Don't sow on poorly drained soil.
3. Don't seed a large acreage to begin with.
4. Don't say alfalfa can't be grown in New England.
5. Don't sow on any but sweet, well-drained soil. Alfalfa is a desert plant.
6. Don't sow on any but a well-prepared, well-settled seed bed.
7. Don't fail to give ample inoculation; both seed and soil inoculation are best.
8. Don't pasture the first year, and don't pasture when wet.
9. Don't feed alfalfa as you do hay, feed it as you do grain.
10. Don't spend your hard-earned money for protein feeds; grow alfalfa, clovers, Canada and cow peas and soy beans.
11. Don't lose the leaves; they are the best part of the plant. Use hay caps.
12. Don't give up. Many prominent alfalfa growers succeeded after some failures.

Question. Could you tell us where we can get the calcium limestone?

Professor Cromwell. That will come out in the discussion. I am very glad you folks have changed so that you can get lime here. While your experiment station said a year ago that it cost $6 a ton, it now costs $3. We get it from West Virginia for $3.10 a ton. You certainly ought to get that lime for around $3 a ton.

Question. In a case I know of the cows didn't like the alfalfa leaf. Why was that?

Professor Cromwell. I suspect you must have had a wet period about the time you mowed, and you had some leaf spots. Generally, cows and hens like the leaves better, but horses like the stems.

Mr. Abner Towne. I would like to ask how much seed you would recommend to be sowed to the acre.

Professor Cromwell. The men in Chester County, Pennsylvania, who have had 5½ tons per acre have put on 30 pounds of seed. Now, that is too much, — entirely too much. But for some reason we can't get very big yields without it. Twenty pounds ought to be enough if you have good enough seed.

In the west they only use 12 or 14 pounds to the acre. I am afraid it is because of our poor seed.

QUESTION. Do you put lime on every year?

Professor CROMWELL. If you use the litmus paper test, or have any reason to think your soil is sour, I would put on 2 tons of ground limestone just preceding your seeding, then I would take off two crops of alfalfa, worth $100 a year, and then I would put on another ton every two years as long as the alfalfa stands.

QUESTION. What do you say about drilling or broadcasting?

Professor CROMWELL. The ideal way to sow alfalfa is to sow it with the disk drill, drilling both ways of the field, one-half one way and the other half crossways of that, and if you have a disk drill I think you might get along with 20 pounds of seed quite well. We have one man this year whose field looks well and who used only 20 pounds with the disk drill.

QUESTION. Will you tell us something about raising alfalfa on gravelly soil?

Professor CROMWELL. If you have a southern slope so full of stones that corn won't mature there, I would expect to get 2½ or 3 tons of alfalfa. It is the only crop except sweet clover which will grow there.

Mr. J. F. ADAMS. I want to relate a little of my experience in trying to raise alfalfa, and then I want to ask the professor why I didn't succeed. One year ago last July I seeded to alfalfa about two acres of ground. The year before I planted corn, and before planting the corn a good coat of barn manure was plowed in about 8 or 9 inches deep, and in the spring about a ton and a half of lime put on. The lime cost me, delivered at my steamboat landing, about $9.20 a ton. I put on basic slag at the rate of 1,000 pounds to the acre, and potash. When I was ready to sow the alfalfa we distributed over the ground about 100 pounds of nitrate of soda to the acre. The ground was tilled thoroughly all summer whenever weeds made their appearance, with a disk harrow most of the time, occasionally with a spiked-tooth smoothing harrow. In July, when I was ready to sow my seed, I bought the best seed that I could get. I bought it from our local seed dealer, and inoculated the seed with something that came in a small bottle. The instructions told me to put the bag of alfalfa seed into a pail of water and let it moisten there, and then take the seed and pour it out on a cloth, and then put the inoculation on. I sowed the seed by hand. I understood I should sow it in a wheelbarrow seeder, but failed to as the inoculation seemed to be a little sticky. The seed came up splendidly, but there were some poor spots. The seed lived through the first winter beautifully and started up in the spring in very good shape, and I got a fair crop, — about a ton and a half to the acre, — what I would consider down there where I live a fair crop. The second crop started, and after a very short time some kind of a blight struck the plants. I don't know what it was. Professor Foord, I think, can tell us something about it, because I sent him a sample. The second crop was mowed earlier than, perhaps, I ought to have mowed it, but the reason for getting the second crop in when I did was because the army worms had struck it with full force and if I didn't get the alfalfa in I expected to lose it with the army worm. So I cut the alfalfa before the buds had started from the bottom, — before the third crop had started. We had some wet weather, and the army worms continued to eat it. It didn't wilt fast enough so that the army worms cared to leave it, and when the sun did get out there was not alfalfa enough left to raise. You could hardly see where I mowed any alfalfa. There was not enough to pay for raking. The third crop came up, but not very strong, and there seemed to be a blight on that, and to-day I don't believe there is one plant left in a field of nearly two acres. Now, I want to know why those plants died.

Professor Cromwell. I suspect that Professor Foord knows more than I do about why that failed.

Professor Foord. I would like to say that the sample that Mr. Adams sent us, and also some that I took myself, were turned over to our plant pathologist, and he stated that the disease, so far as he could find it, was not an alfalfa disease. The only suggestion I could give on Mr. Adams' proposition was the question of seed. He got the seed from the local dealers. After the second crop was cut and the army worm had been there, there were a good many weeds. With the tillage that Mr. Adams gave the field it does not seem to me there ought to have been as many weeds there. They may have come in with your seed. I have a good many friends in the seed trade, but I like to jack them up a little occasionally. I think the seed problem in New England is an important one. I hope Mr. Adams will not feel discouraged on that two acres, but will go at it again.

Mr. Adams. I will say that I have no idea of giving up that field of alfalfa at the present time, although that field cost me about $40 to the acre. I am going to plant it to alfalfa again, if nothing happens.

Professor Cromwell. Let me relate the experience of one farmer in our county. After the first cutting he said, "My alfalfa is not what it should be. I want to find out what is the trouble with it." So he went over the field and dug up half of it and found that the plants had only gone about 4 inches in the ground and the root was black. He thought he had a bacterial disease and asked us what was the matter. We sent to Washington and had them send out a specialist. It seemed the man had plowed up a badly infested clover field, and the clover worms were unable to get any food, so they were migrating in large numbers to that alfalfa, and were killing it. The alfalfa was coming up with a stem only 4 inches long. Now, because you didn't dig for the bacteria, you didn't know about the clover worm. That may be the solution of that problem.

Question. Will you say something about the depth to plant, the covering and whether to use a roller or not?

Professor Cromwell. My advice would be to plant the alfalfa ½ to 2 inches deep, depending on the moisture, and then have the ground harrowed. Do your rolling before you plant.

Mr. Towne. Would it be practicable to use alfalfa to renew old pasture lands; in other words, would it be a good thing for pasture and for cattle in pastures?

Professor Cromwell. It was my good fortune this summer to have an automobile ride of 150 miles, studying pastures. A man from the Department at Washington came up to get some information — by the way, you folks notice that to-day the agriculturist goes out to the farmers to learn, instead of the farmers always coming to him to learn. I found one man pasturing 90 head of cows on 60 acres of high, hilly land, with the driest range in forty-two years, and his cattle had plenty of pasture. He said, "I can't get a good pasture without plowing up and putting it into alfalfa, getting two crops, and then sprinkling on some grass seed and letting it come to grass." I certainly would sprinkle a little handful of alfalfa with all my seeding, — timothy, clover and so on, — so that in time all of your soil will be thoroughly inoculated. That will take some years, but it certainly should be done, — a pound or two or more to the acre of every field that you seed from now on.

Mr. Towne. That brings to my mind that about six years ago I sowed about five acres of land, and in the seed was some alfalfa seed which came up in spots all over this piece of land. I was so delighted with it that I said to myself, "Why, that land will be inoculated, and I can raise the finest field of alfalfa in the country." For two years it seemed that every plant grew and the roots were large and well-established, and last fall I had an idea that I could cut it and use it for my hens, as it came up in bunches. I cut it and this year I have only one plant left.

Professor Cromwell. You killed the goose that laid the golden egg that time.

Mr. H. D. Fuller. I used the Galloway culture, which a neighbor of mine procured from Iowa. This year I have mowed it three times; the first time I got about a ton, the next time a ton and a half, and the last time about a ton, I think.

Professor Cromwell. I don't know the Galloway cultures. Is it a water culture or a gelatine culture?

A Voice. You use water with it.

Professor Cromwell. My experience — and the United States government does not agree with me in this — is that the water cultures are very sensitive to the light. You can't keep them more than a week or two before you kill your bacteria. The gelatine cultures live longer. The water cultures are good if fresh, but you must use them almost immediately when you get them. I am awfully sorry that the gelatine men patented their process, because I am satisfied that the gelatine is much better. Our men pay $1.40 an acre for culture. We buy through our farm bureau. We have one of the farmers act as buying agent.

Mr. C. H. White. I would like to say that the Worcester County Farm Bureau is just starting — it is only two days old, but we are here for business, and I hope that you men in Worcester County, who hope to get lime this year, will confer with the Farm Bureau.

Professor Cromwell. I want to make a comment on that, because that is the greatest movement you have. There are too many of you folks to write to the State college and the United States government and have much attention paid to it. Now you have a specialist between you and the State college and the United States government. Now you have a man who is salaried and who represents you, and the scientific knowledge at Washington and at the State college is to be put to work on your problems absolutely free. And it seems to me that there is no institution that can do more to help you. You men don't know what your neighbors are doing in the adjoining townships, and there is not a move you can make that will help you in the alfalfa business more than to have a man who can gather all the experiences together, both failures and successes. This man's business is to find what is good lime and what is not, to find what diseases you have and what you do not have. He can ask the State college in an authoritative way, and can ask Washington, so that Washington will put the brainiest men they have on your problems. A farm bureau is a vital problem in solving the questions in your county.

Question. I have been told that there was no seed grown in the United States except in Utah. Is that correct?

Professor Cromwell. I believe that the seed men are just as honest on the average as we are, but they are wretchedly careless about alfalfa. That statement is not true. There is lots of seed grown in Kansas, and there is lots of seed grown in Nebraska. Those States are south of you, and that seed will winterkill if brought to Massachusetts, but there is plenty of alfalfa seed grown north of this State, and standing winters harder than yours. We must give our seedmen to understand that they have got to deliver the goods or something will happen in the seed business. There are hundreds of thousands of bushels of Asiatic alfalfa seed landed on our eastern United States, and of course it gets to you farmers first, and it gets to the Nebraska and Iowa farmer last. Much of it is useless; it is too old. So I think it is a vital problem to have some man like the Farm Bureau man to put it up to the seedsmen to deliver good seed. I believe you can get the seedsmen to do this for you. While we could buy seed for $7.80 a bushel, the men who got the best crops in our section paid $14 a bushel. They could afford to send a man to Montana and buy seed. We bought $2,000 worth of seed from one dealer. One of the Philadelphia dealers said the other day, "I guess the alfalfa business is a failure because I sold less seed this year than I have in ten years." The seedsmen have got to wake up, and they must tell us where they get their seed and where it was grown.

Professor Foord. Mr. Westgate, from the United States Department, told me three or four years ago that there were 5,000 acres of seed alfalfa in Ontario. Mr. Westgate had been through the province and knew what he was talking about. We have had excellent results from seed obtained from that section. Their winters are as severe as ours. In the early days of drought agitation we were told alfalfa would grow on sand. Now, tie together what Mr. Cromwell has said with the picture of the manure spreader. If you don't you will make a failure of it. Alfalfa wants some fertility. It is a weak, sickly little plant when it starts. When raising it experimentally in the southern part of the State, where you have a lot of sandy soil, you must have that manure there to stimulate the bacteria and to get fertility until we get it started. I was interested two years ago, in walking up from the pier down off Cape Cod, to see right beside the road a great big bunch of sweet clover, and just beyond that, right on the seashore, they were mowing alfalfa. That is on sandy soil. Within 30 feet of the seashore, with the northeastern exposure, coming right down to the shore, was alfalfa planted. I had some friends in that cottage, and in the fall I took some spears from that alfalfa plant that had seeded, but not fully ripened, and I just stuck them in a paper bag and tied them up and put them in my grip and laid them on a shelf in my study. That seed fully ripened. That was within 30 feet of a northeastern shore coming down on Cape Cod. So there is no doubt but what we can raise seed of our own in New England. Mr. Prescott of Concord has told us that we can raise our own seed. I don't want to advocate raising alfalfa seed, but I wanted to tie together the sand and the manure spreader, because if you don't you will make a failure as we did in the beginning.

Mr. C. R. Harris. I want to ask about the use of lime. The speaker has very strongly come out for the use of ground limestone. Now, my farm has a heavy clay soil, and I have been using a caustic lime, and the alfalfa has grown, I think we can say, successfully. There is one field from which we have taken three cuttings. Some of my neighbors have also used the lime out of the same car, and their fields have grown equally well. Now, would it be better to stop using the caustic lime on this particular kind of soil and use the ground limestone? There is an economic advantage, of course, in the cost of lime which I am anxious to get if we can use it.

Professor Cromwell. Of course, if the caustic lime has been on the field long enough before your alfalfa bacteria get there, why there is no difference between caustic lime and ground limestone. It is only where you use it immediately before that I fear it. And yet I know of instances where people have plowed under heavy green crops and have gotten splendid results with caustic lime. But I think there are eight failures to one success with caustic lime used immediately before you sow the alfalfa. Did you do that?

Mr. Harris. Perhaps in the light of what you say a further explanation is necessary. Our method of growing is to follow oats cut for green fodder with alfalfa, and the alfalfa seeding would take place, probably, not more than a week after the application of the lime, and we have seeded in that way with success, both myself and my neighbors.

Question. Would you cut alfalfa that is affected with the leaf blight?

Professor Cromwell. I certainly would cut it just as soon as I saw that the leaf blight was going to be serious.

Mr. C. W. Prescott. In regard to what Professor Foord said about manuring, I would like to state that we have been growing alfalfa in Concord without any manure and got good crops on sandy land. We have only had one field that has winterkilled badly. Grimm has gone through the winter much better than any of the others, but some of the imported Turkestans have gone through the winter just as well as the other seed from northern-grown sections. I don't think it is necessary to have manure in order to grow alfalfa, though of course you may get larger crops.

Professor Foord. I think I ought to ask if there is any difference between Concord sand and Barnstable or Plymouth County sand?

Mr. Wheeler. The Concord sand is not so good.

Professor Cromwell. I want to agree with Professor Foord, that every man should use manure. We had the driest June in forty-two years in 1914, the wettest July in fifty years, and the driest September and October in fifty-two years, — a very abnormal season. Probably that very wet July accounts for so much leaf spot this summer. That may not occur again for years.

Professor Foord. I spoke of the Ontario-grown seed. If you get in touch with the representative of Welland County you will get in touch with the farmers there who are growing a variety which seems to me a pretty strong variety and stands the winter there, and I should think would stand the cold weather here.

On motion of Mr. Wheeler, a rising vote of thanks was tendered Professor Cromwell for his address. The session was then adjourned.

SUMMER FIELD MEETING

OF THE

STATE BOARD OF AGRICULTURE

AT

LOWELL.

JUNE 24, 1914.

SUMMER FIELD MEETING.

The summer field meeting of the Board was held at the Hood Farm, Lowell, on June 24. About 600 farmers with their families who attended saw and heard an interesting program. In the forenoon Winthrop Fillebrown of Bryantville gave a demonstration of ditching and subsoiling with dynamite, and H. L. Frost of Arlington demonstrated summer spraying. There was also a stock judging contest and A. E. Briggs, Secretary of the Boston Fruit and Produce Exchange, spoke on "Marketing Farm and Garden Products."

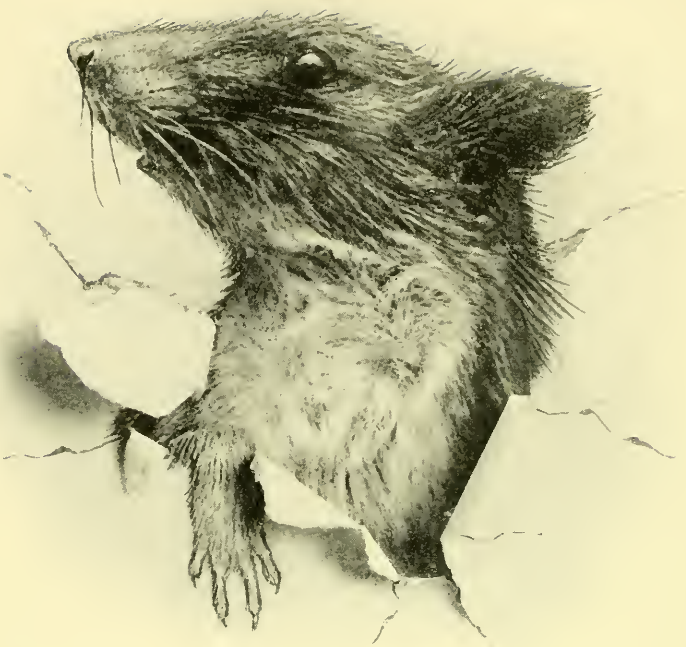
At the afternoon session Professor F. C. Minkler of New Brunswick, New Jersey, gave a talk on "Profitable Pork Production," and Winthrop Fillebrown gave a demonstration on blasting stumps and rocks. A continuous demonstration of the Skinner Irrigation system, an exhibit of parcel post packages and farm machinery, and the opportunity to see one of the best herds of Jersey cattle in the world, all added to the interest of the day.

ECONOMIC BIOLOGY BULLETIN No. 1.

RATS AND RAT RIDDANCE

BY

EDWARD HOWE FORBUSH,
State Ornithologist.



The Most
Expensive Animal
that Man Maintains; Forerunner of Famine, Disease, and
Pestilence. Disseminator of the
Dreaded Trichina and the TERRIBLE BUBONIC PLAGUE or "BLACK DEATH," which has
slain its miserable horror-stricken millions since the
dawn of history, and now has spread to the United States.

PREFATORY NOTES.

It may be asked why the State Ornithologist should write a bulletin on rats. In reply to this it may be said that economic ornithologists as such are especially interested in the destruction of rats for two reasons: (1) rats are very destructive to the eggs and young of birds, whether wild, captive or domesticated; (2) many people who have given up keeping cats because of bird-killing habits now wish to know how to get rid of rats. Hence, the suppression of rats becomes a problem for the economic ornithologist. In 1912 Mr. J. Lewis Ellsworth, then secretary of the State Board of Agriculture, deemed these reasons sufficient to propose the preparation and publication of a bulletin on rats and rat riddance. The proposition was enthusiastically received by the members of the Board, the task naturally fell to the State Ornithologist, and here is the bulletin.

In the experimental work undertaken during the last two years as a preparation for the publication of this bulletin thousands of rats have been destroyed. The exact number cannot be given, owing to the fact that chemical poisons and fumigants were used in some cases, and where such methods are utilized the exact number killed cannot be ascertained.

The author takes pleasure in acknowledging his great indebtedness to the excellent publications on rats issued by the Biological Survey of the United States Department of Agriculture, and particularly to Professor David E. Lantz of the Survey, the author of these and other rat papers, who has furnished many facts contained in this bulletin, for his kind assistance and for valuable information received from him personally.

The author is equally indebted to the Public Health and Marine Hospital Service of the United States Treasury Department for valuable publications, to Surgeon-General Rupert

Blue of that service for many courtesies, including the use of electrotypes; also to Assistant Surgeon-General William Colby Rucker and Surgeon Richard M. Creel for photographs, and to all these gentlemen and Passed Assistant Surgeon J. R. Hurley for valuable and authoritative information.

The small line cuts illustrating this bulletin were made from pen sketches by Mr. Walt F. McMahon.

RATS AND RAT RIDDANCE.

INTRODUCTION.

With the lapse of ages the rat has become a parasite on man. It has developed into the greatest rodent pest ever known. It is far more destructive, directly or indirectly, to human life and property than any wild beast or venomous serpent. It appropriates nearly everything that man eats, and drinks many of his beverages. It follows him with its baleful influence from the cradle to the grave. It destroys his poultry and molests his domesticated animals. It has been known to attack and mutilate infants, sleepers, the sick, aged and infirm. It is the forerunner of famine, pestilence and death. It carries the germs of disease. It infects man's ships and habitations with the dreaded plague; sets fire to his dwellings and ships, and ceases its ravages only when the house burns or the ship sinks. As if not satisfied with pursuing him through life, it follows him in death, desecrating and mutilating his mortal remains.

It is the duty of all nations to take part in the destruction of this abominable pest. Dr. William Colby Rucker, Assistant Surgeon-General, Public Health and Marine Hospital Service of the United States, says that we must work and we must teach, and so bring about an antipathy toward the rat greater than the present antipathy toward the snake. Also, we must inculcate the lesson that "the rat is the most expensive animal that man maintains," and that its suppression and control are as important from an economic as from a humanitarian standpoint.

RAT HISTORY.

House rats and mice came to America in ships from the Eastern Hemisphere. They belong to the old world genus *Mus*. The house mouse (*Mus musculus*) may be regarded as a small rat, as it has similar habits; the black rat (*Mus rattus*) is medium in size, and the brown, Norway or wharf rat (*Mus* *norvegicus*) now the common rat of New England, is the largest, sometimes reaching a length of nineteen inches, including the tail. I have seen one taken that weighed nineteen ounces, possibly they may grow much larger,[1] but those commonly seen are smaller. In New England this species is by far the greatest pest of all.

The house mouse reached New England soon after its settlement, and the black rat had become well established here early in the eighteenth century. From that time until long after the American Revolution it was the common house rat of America; but the arrival of the cannibal brown rat, in the latter part of the eighteenth century, doomed the black rat to extirpation. Here, as in Europe, the latter was driven out by the former, and now the black rat is found only in small numbers, and in regions remote from coasts and large cities. Black rats were common about 1870 in towns of central Worcester County, Massachusetts, where now they have been extinct for years, but there are still a few left in some interior towns.

No one positively knows the native country of the brown rat. Probably it did not originate in Norway, Persia or India, as some writers have asserted, and it seems to have been unknown to early Europeans. It is said to be practically unknown in Persia, and is found in India mainly near the coast and on the navigable rivers. The black rat is far more widely distributed in India than the brown rat. The latter probably is of Asiatic origin, and is said to have reached England from some eastern port about 1728, shortly after it had crossed the Russian frontier from Asia.[2]

RAT HABITS.

The first step toward effective destruction of rats is a study of their habits and food. Rats appear to be naturally nocturnal, as they move about readily in the dark, feeling and smelling their way along walls and into holes and passages. Their ears, noses, "whiskers" (*vibrissæ*) and feet are very sensitive, and serve well to guide them in the dark, but if too closely pursued by nocturnal enemies they can easily change their habits, feeding in daylight and sleeping at night. The brown rat may be seen abroad at any hour, especially at morning and evening. It never likes to go far from some hole or hiding place to which it can retreat at the first sign of danger, and if it has to cross wide fields, it prefers to go through bushes, grass or grain, along some wall or fence, or through or near a ditch, where it can find shelter. In many cases it burrows in the earth in fields, either near water, where it goes to drink, or near its food supplies. Sometimes these burrows are used only as places in which to hide from its enemies, but it often lives all summer (and under some circumstances all winter) in burrows in well-drained banks of rivers or small streams, or along the shores of islands in the sea. The brown rat drinks large quantities of water, and must have water, snow, rain or dew in plenty at all times, hence its preference for banks of streams, ditches, pools and springs. Also it is perfectly at home in water, and can swim rapidly and easily for half a mile or more, and it dives and swims readily under water. It nests and rears its young in burrows in and under buildings and under rubbish piles, and there it also stores more or less food for use in times of want or danger.

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[1] The Field (London, Sept. 20, 1913, p. 666) records the weight of several much larger specimens, as follows: one, 1 pound 13 ounces; one, 1 pound 15 ounces; two, 2 pounds each; one, 2 pounds 8 ounces; and one, 2 pounds 12 ounces. No measurements are given. The English climate must be extremely favorable to the development of the brown rat.

[2] Lantz, David E., U. S. Dept. Agr., Biol. Surv. Bull. 33, 1909, pp. 11–13.

Rats live outdoors more in the south than in the north. In rural New England, especially where grain is grown, the brown rat lives chiefly in fields in summer and in and around buildings in winter. In villages and cities rats stay much about buildings all the year, but some migrate into the open in spring and return to the buildings in autumn. Rats migrate in large numbers whenever food fails, crossing deserts and rivers that may lie in their path. Hunger thus accounts for the great invasions of rats that sometimes occur. It is a well-known fact that rats catch and eat mice, but they never can exterminate mice, for the same reason that cats cannot extirpate rats. Mice are so much smaller than rats that they can run into holes where the latter cannot follow. Therefore rats and mice are commonly found in the same buildings or fields. It is not generally known, however, that brown rats are cannibals. The adult male will search out and eat its own offspring; but, on the other hand, the female will defend her young gallantly. James Rodwell, in an interesting little volume on the rat, containing many facts and some exaggerations, tells of a battle between two rats that he witnessed. Numbers of their companions gathered from all directions. All waited until one was conquered and dying, then fell upon both combatants like a pack of hungry wolves and tore them to pieces.[1] It is a common occurrence for a rat caught and injured in a trap, but not killed outright, to be set upon and eaten by its companions. I have known of many such cases.

The rat is a courageous animal and when cornered usually will face great odds in defense of its life, and fight to the last breath. Not all individuals, however, exhibit the same dauntless courage. There is more difference in rats than appears as they run off.

Dr. Richard H. Creel of the Public Health and Marine Hospital Service of the United States has made some investigations into the habits of rats in their relation to antiplague measures. His investigations furnish useful information to those who wish to rid their premises of rats. Five full-grown brown rats were placed within a stockade made of galvanized iron, sunk three feet into the ground. The rats being confined forty-eight hours failed to burrow under the stockade. No burrow extended downward more than two and one-half feet. Black rats so confined made no attempt to burrow. The brown rat burrows with the greatest ease, even in the hardest packed ground, and has perforated walls of sundried brick held together by sand-and-lime mortar, in some cases actually piercing the body of the brick. The English Plague Commission credits the brown rat with ability to gnaw through brick or concrete, but it is incredible that it can penetrate properly prepared concrete after it once becomes well hardened.

In one of Dr. Creel's experiments a brown rat, in an attempt to scale a stockade, jumped upward and outward a distance of seventeen inches. Black rats jumped upward two feet in their efforts to scale the stockade, and in one instance one of them, confined within a perfectly smooth galvanized-iron can two feet in depth, spiraled its way to the top by a series of jumps, and escaped. Rats were unable to climb up the inner or outer corner of a concrete building. Three species — the brown rat, the black rat and the roof rat (*Mus alexandrinus*) — climbed a one-inch standpipe and a cocoanut tree with the greatest ease.[1]

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[1] Rodwell, James, The Rat; its History and Destructive Character, 1858, p. 22.

Rats have been observed climbing on elevator ropes and cables to the upper stories of the highest buildings, and crossing from building to building on telephone wires. Many authors state that the brown rat is found mainly in the lower parts of buildings and that the black rat and the roof rat seek the upper floors. Nevertheless, black rats go into cellars and brown rats almost always explore the attics of houses, especially those which contain open water tanks; also they have been found in the upper stories of some high buildings.

RAT FOOD.

Rats, like all rodents, are fitted to feed on vegetable matter, grain, hard seeds, roots, nuts, etc., but in the course of time they have become practically omnivorous, eating almost anything edible, and gnawing many substances that have little or no food value.

RAT FECUNDITY.

Possibly no mammal pest is more prolific than the rat. The fabulous speed of its multiplication baffles all but the most efficient and determined attempts at extermination. Kolazy says that he kept two female white rats in confinement that produced twenty-six litters, or 180 young, within thirteen months. Rodwell says that the female brown rat is believed to bring forth from six to eight litters yearly; but estimating

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[1] Creel, Richard H., Public Health Reports, Vol. 28, No. 9, Feb. 28, 1913, pp. 382–385.

that a pair produces only four litters, six in each litter, each rat living three years, he figures that in that time the progeny of one pair would be 651,050.[1] In temperate latitudes the brown rat is now known to breed from three to five times each year, bringing forth from six to twenty young each time. Assuming that the animal breeds but three times a year, and produces on the average ten young at each period, Prof. David E. Lantz estimates that with no deaths the number at the end of the third year would reach 20,155,392 individuals.[2] Dr. William Colby Rucker, Assistant Surgeon-General, United States Public Health Service, computes the theoretical increase of a pair of rats for five years at 940,369,969,152.[3] It is hardly necessary to say that such results as these could not occur in nature, but these figures indicate the immense possibilities of this pest under favorable circumstances. Let mankind rejoice that rats are cannibals.

RAT NUMBERS AND DESTRUCTIVENESS.

If an exact census of the rats in the United States could be taken, their numbers probably would be beyond belief.

Few people realize how many rats infest their premises. Possibly there are none in some localities, but there are very many more in existence than ever are seen by human eyes. The number varies from a few pairs on some well-cared-for estates to hundreds in ratty tenements and farm buildings, and thousands on ill-protected farms and country estates. Rats come and go mysteriously in some localities. There are some large areas in the country where very little grain is raised or used, or where for some other reason rats are not numerous; other regions swarm with them. Farmers or householders, when interrogated, usually admit that they have a few rats. Careful investigation, however, sometimes shows that the farmer suffers an annual loss, equal perhaps to his taxes, because of the grain eaten or wasted by rats in the fields and stolen from his fowls, cattle, horses and hogs, from his stored unthreshed grain, or from barrels and bags in barns or storehouses, to say nothing of the toll taken from fruit, vegetables, poultry, eggs and other food.

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[1] Rodwell, James, The Rat, 1858, pp. 167, 168.

[2] Lantz, David E., U. S. Dept. Agr., Biol. Surv. Bull. 33, 1909, p. 16.

[3] Treas. Dept., Public Health and Marine Hospital Serv. of U. S., The Rat and its Relation to the Public Health, by various authors, 1910, p. 153.

I have visited livery stables the proprietors of which believed that they had but few rats, but careful observation showed that considerable sums were lost yearly through unnoticed thefts perpetrated by numerous rodents that nightly entered the open, unprotected or carelessly closed grain bins, and daily fed in the mangers with the horses. These gentlemen relied on wandering cats that had taught the rats to keep out of sight.

Rats are numerous in cities and villages, particularly in grocery, provision and grain stores, warehouses and grain mills, and many proprietors of these places practically have given up trying to repress them, and have resigned themselves to serious losses.

Rats multiply most rapidly if well fed, sheltered and little molested. They find favorable conditions on farms where grain is grown. In 1901 a country estate of 2,000 acres near Chichester, England, was so badly infested by rats that 31,981 were killed within five years, under the supervision of the owner, and it was estimated that the tenants, while threshing the grain, had killed 5,000 more.[1]

In Jamaica in one year 38,000 rats were killed on one plantation.[2]

Farm holdings in England often were, and still are, badly infested. Rodwell says that a boy in Shropshire killed 630 rats in about four months, and it was computed that there were at least 1,260 rats on this farm of 280 acres. On another farm, of 400 acres, when the barn was emptied, after the threshing, over 1,400 rats were killed, and numbers escaped into drains and rabbit holes. On another place, of 180 acres, a boy was employed with six or eight traps, who caught five or six rats each night during the winter months, and at the emptying of one barn 800 more were killed, making in all 1,340 rats. On an estate, of 330 acres, 1,095 rats were said to have been killed during the year. A rat catcher of Middlesex, with two ferrets, killed in one barn about 250 rats in one day, and more than 200 were killed there the next day. On another farm he caught over 150 rats alive in a small grain rick. Many more were killed and many escaped. A farmer killed more than 700 rats by surrounding a rick with boards and attacking them with a dog.[1]

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[1] The Field (London), Vol. 100, Sept. 27, 1902, p. 545.

[2] New Eng. Farmer, Vol. 12, 1834, p. 315.

Buckland says that an official report from the French government asserts that the proprietor of a slaughterhouse killed 16,050 rats in one month.

Rats are very numerous in this country. In Maryland, in 1832 a farmer and his men and dogs killed 217 brown rats from one stack of rye.[2] At The Farm and Trades School at Thompson's Island, in Boston Harbor, a farm of about one hundred and fifty acres, in one day I counted over 800 rat burrows in the fields and along the shores. This was after many rats had been destroyed and a large number of holes closed. Later, about 1,300 rat holes were found open and rats were numerous also in some of the buildings. The pupils of the school previously had caught in traps about 200 rats a month. From June 6 to August 13, 1913, 572 were caught, but this trapping alone hardly kept down the natural increase.

Professor Lantz states that a farmer at Grand River, Iowa, had about 2,000 bushels of corn in three cribs, and that the rats ate and destroyed about one-fourth of the corn. At that time the farmer was poisoning and trapping rats, having killed as many as 300 in two days. The rats ruined more than enough corn to pay taxes on 400 acres of land.[3] The Moline, Illinois "Evening Mail" of April 25, 1904, states that Mr. F. U. Montgomery of Preemption, Mercer County, killed 3,435 rats on his farm. Most of these were caught in traps, between March 20 and April 20, 1904. In a letter written to Dr. C. Hart Merriam by Mr. Alfred Chisholm of Savannah, it is asserted that on two rice plantations in Georgia 47,000 rats were killed during the winter and spring of one year.[4]

Practically all ships have rats, and their numbers increase enormously, despite the cats which are kept on shipboard to destroy them. The losses to ship stores and cargoes by rats are tremendous. The British man-of-war "Valiant" had so many rats aboard in 1776 that they destroyed more than 100 pounds of bread daily. The ship was fumigated, and six hampers were filled every day for some time with dead rats.[1]

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[1] Rodwell, James, The Rat, 1858, pp. 151–156.

[2] Amer. Turf Reg., Vol. 3, Aug., 1832, p. 632.

[3] Lantz, David E., U. S. Dept. Agr., Biol. Surv. Bull. 33, 1909, p. 20.

[4] *Ibid.*, p. 21.

Surgeon William C. Hobdy relates that the British steamer "Gadsby" on a voyage of twenty-nine days had 44,000 out of 46,000 bags of wheat in her cargo cut by rats, with an estimated damage of $2,200. He says also that a small vessel (260 tons) was fumigated in San Francisco, after which 310 rats were picked up dead, — "a barrelful and seven." On another larger vessel, fumigated some years earlier at Bombay, 1,300 rats were destroyed at one time, and the steamship "Minnehaha," fumigated at London, England, in May, 1901, yielded 1,700.[2]

Organized efforts to destroy rats have been made in various countries, and the numbers killed give some indication of rat abundance. In 1904 at Folkstone, England, the corporation employees, with the help of dogs, in three days killed 1,645 rats.[3]

A rat hunt at New Burlington, Ohio, November 26, 1866, yielded over 8,000 rats. In this hunt sides were chosen, as at a spelling bee, and the beaten party gave a dinner to the winners.[4] A sparrow club in Kent, England, secured the destruction of 28,000 sparrows and 16,000 rats in three seasons by expending £6 ($29.20) in prizes.[5] An international association for the destruction of rats in Denmark succeeded in getting a government appropriation for its work, under which 1,141,293 rats were killed during the first year, ending July 1, 1908.[6] In Copenhagen 103,000 rats were destroyed in eighteen weeks. In seven years 711,797 were killed in Stockholm.[7]

In the work done in American cities to check the bubonic plague great numbers of rats have been killed, although no correct count of them could be obtained, as both traps and poisons were used, but in the first four months about 130,000 were destroyed in San Francisco. In the early months of 1908, up to May, 278,000 were captured, and it was estimated that 500,000 had been poisoned. In a report of the Indian Famine

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[1] Rodwell, James, The Rat, 1858, p. 164.

[2] Treas. Dept., Public Health and Marine Hospital Serv. of U. S., The Rat and its Relation to the Public Health, by various authors, 1910, pp. 208, 209.

[3] The Field (London), Vol. 104, July 16, 1904, p. 98.

[4] Lantz, David E., U. S. Dept. Agr., Biol. Surv. Bull. 33, 1909, p. 51.

[5] Jour. Bd. of Agri., Gt. Britain, Vol. 9, 1902, p. 342.

[6] Jour. Inc. Soc. for Destruction of Vermin, Vol. 1, Oct., 1908, p. 32.

[7] Lantz, David E., U. S. Dept. Agr., Biol. Surv. Bull. 33, 1909, p. 53.

Commission, presented to the British Parliament in 1881, it was stated that a plague of rats infested the Southern Deccan and Mahratta Districts, that rewards were paid for the destruction of the vermin, and that over 12,000,000 were killed.[1] In all these cases the number of rats killed may be regarded merely as an indication of the number in existence. No one knows how many escaped.

Enough has been recorded here to give some idea of the enormous numbers of rats that infest the world, and we may next turn to a consideration of their destructiveness.

Farmers assert that when rats become numerous the injury to crops passes all bounds. They sometimes swarm in grain fields. Corn fields are absolutely ruined by them. They climb the stalks and strip the cobs clear of grain. I have seen much corn destroyed by them in this manner, and Professor Lantz avers that he has seen whole fields thus ruined. A writer in the "American Agriculturist" says that rats destroyed three-fourths of the corn on thirteen acres of land.[2] Rats usually eat only the softer part of the kernel, wasting most of it. Sweet corn is a favorite grain.

It may not be commonly known that rats often dig up seeds which have been planted, and in this way they may become more destructive than crows, squirrels, pheasants or marmots. On Thompson's Island the corn on more than two acres was destroyed in this way in the spring of 1913. There are no squirrels, no pheasants and no woodchucks on the island and crows do not breed there. Ordinarily rats do not trouble peas or beans, but they have been known to dig up quantities of the planted seed and to attack peas and beans, both stacked on farms and stored in Boston warehouses. Large portions of the crops of wheat, rye, barley, oats, etc., are taken by rats and mice in the fields, and when unthreshed grain is stored in barns or ricks rats swarm to it, and if left to themselves they destroy most of the grain. They take large toll from the rice planter and the sugar planter. Enormous quantities of corn and feed stuffs are eaten by rats, a little at a time, in granaries, feed stores, stables, barns and poultry houses. They are fond of malt, and cause the brewers great loss. Great quantities of flour and meal in bags are eaten by them, and much more ruined or depreciated in quality by the filth which they distribute. While trapping rats in a dwelling house I found stored in the barn twenty twenty-five-pound bags once filled with flour, nearly all of which had been eaten or ruined by rats.

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[1] British Med. Jour., Sept. 16, 1905, p. 623.

[2] Amer. Agriculturist, Vol. 33, 1874, p. 300.

Small fruits disappear mysteriously, and birds that are known to eat them receive the blame; in many cases rats are the culprits. Rats, like squirrels, can climb bush, tree or vine. Unlike squirrels, rats work mainly in the night and escape notice, but they have been seen taking fruit from trees in daylight.

Dr. L. O. Howard, Chief of the Bureau of Entomology, United States Department of Agriculture, records the fact that in a single afternoon he shot 28 rats from the branches of a cherry tree in Washington, District of Columbia. Rats have been seen to steal cherries in England, and both the black rat and the roof rat are shot in large numbers from the branches of fruit trees and other trees in the south.

Capt. R. R. Raymond, United States Army, asserts that at West Point, New York, when visiting some cherry trees he frequently met rats in the trees on the same errand as himself.[1]

Fruits and vegetables, when stored in buildings and cellars, are attacked by rats. Quantities of grapes, oranges, bananas, figs, dates and cocoanuts, and pods of cocoa from which chocolate is manufactured, are ruined by them. Grapes grown under glass especially are subject to attack. Massachusetts farmers report destruction of apples and potatoes in their cellars in quantities, aggregating hundreds of barrels. Rats are very destructive to tomatoes at times and to melons and squashes, which they appear to gnaw into mainly to obtain the seed, thus ruining far more than they actually destroy. Vegetables and fruits in transit on railroads and steamboats and in freight houses are eaten. Rats destroy cucumbers, sweet potatoes and grapefruit in this way. Rats eat seeds, bulbs, stems and leaves of flowering plants. Florists' greenhouses are invaded by them. Tulips seem to be their favorite bulbs, and there are many tales of the loss of quantities of tulips; hundreds of bulbs are sometimes destroyed by rats in a single night. Rats destroy pinks (carnations) and roses, of which they seem to be particularly fond; also hyacinths and chrysanthemums. Many growers have had their choicest flowers ruined by them.

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[1] Lantz, David E., U. S. Dept. Agr., Biol. Surv. Bull. 33, 1909, p. 24.

Rats are fond of meats of all kinds and devour them wherever they can be found. The injury begins at the slaughtering establishment. Most slaughterhouses are infested with hordes of rats, which live on blood and offal and attack the meat whenever an opportunity offers. No meat of any kind is safe unless kept in rat-proof refrigerators. Rats get access to the meat in some of the lower class markets and sometimes destroy a considerable quantity in a single night. Pantries, larders and cellars, wherever meat or game is kept, are raided by rats at every opportunity, and the loss from this source is very great.

Rats gnaw into butter tubs, excavate and honeycomb fine cheeses, and consume and ruin more or less milk and cream. They drink and contaminate human beverages of many kinds if left uncovered, sometimes even gnawing into casks of wine or cider.

The complaints regarding the ravages of rats among poultry are pathetic. In some years 50 per cent. of all the chicks and ducklings hatched in certain neighborhoods are killed by rats, and occasionally a single poultryman loses hundreds of chicks by them. Rats often rob hens' nests as soon as the eggs are laid, carrying the eggs away without breaking them, so that a great part of the loss is never even suspected. Pigeons' eggs and young are just as readily taken as those of the larger fowls, as rats are very skillful in climbing for them. When it is considered that the annual product of eggs and poultry from the farms of the United States considerably exceeds $500,000,000 in value, it will be seen how serious a loss rats may cause to this industry, and to the middlemen and retailers as well.

Professor Lantz tells of a commission merchant in Washington, District of Columbia, who lost 71½ dozen eggs by rats from a tub in which 100 dozen had been nailed up.

The loss of young chicks and eggs is not the only poultry loss suffered by poultrymen and dealers. According to Dr. Bos, rats have been known to bite flesh from living fowls,[1] and some writers have asserted that rats can and do kill full-grown fowls.

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[1] Bos, J. R., Agricultural Zoölogy, 1894, p. 39.

Rodwell avers that in a short time he lost by rats all his rabbits, guinea pigs, pigeons, and a large "setting" hen and her complement of eggs, and he mentions other instances where full-grown fowls and ducks were believed to have been killed and partially eaten by rats.[1]

Dr. Brehm says that Las Casas tells us that on the night of June 26, 1816, the rats ate all the provisions in Napoleon's house on St. Helena leaving him and his companions breakfastless, for poultry keeping had been abandoned because rats ate the fowls, even stealing them from their roosts in the trees.[2] I have doubted that it was possible for rats to kill full-grown fowls, but recently have secured corroborative evidence from poultrymen. Mr. C. H. Bradley, superintendent of The Farm and Trades School at Thompson's Island, says that rats have gnawed the flesh from living turkeys at the farm, attacking them near the tail or eating out part of the breast. Some recovered, others died, and he has lost hens in the same way. Miss Florence E. Curtis writes from Whitman, Massachusetts, that rats kill her hens by eating off their heads at night, and Brewster and Dupuy assert that rats kill chickens, ducks, geese, partridges and the like, overcoming them, in spite of their size, by one deft bite through the neck.[3]

Mr. John B. King of Newburyport says that so long as rats can get a plentiful supply of grain they will not touch the poultry, but he says that his neighbor, Mr. Frank E. Silloway, who raises partridge cochins, has lost ten hens and one cock, averaging about eight pounds in weight, and that another neighbor has lost several brahmas in the same way. The rat usually gets the fowl by the head, and is thus enabled to hang on until the bird is dead, or it bites it through the neck (some old rats are very skillful at this); then the flesh on the head and neck is commonly devoured first, or the brains are eaten out. Mr. King says that at one time when he was breeding brown leghorns and keeping his grain in a rat-proof box, he frequently found the heads of some of his fowls mangled and bloody in the morning. Finally he found one dead, and one eye and the side of the face eaten off.

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[1] Rodwell, James, The Rat, 1858, pp. 74, 76.

[2] Brehm, Alfred Edmund, Life of Animals, 1896, p. 334.

[3] Dupuy, Wm. Atherton, and Brewster, Edwin Tenney, McClure's Magazine, May, 1910, Our Duel with the Rat, p. 69.

Mr. Bradford A. Scudder tells me that Mr. Henry W. Walker, a neighbor, told him that within the past six months more than a dozen of his hens had been killed or seriously injured by rats. The dropping board was close below the perch, and some of the hens were attacked in the abdomen. Others were killed apparently by a bite through the neck, and their brains were eaten out. He believes that this was the work of rats, as no other animal could have gotten at the chickens in that place.

In August, 1914, I visited the heath hen reservation maintained by the Massachusetts Commissioners on Fisheries and Game on Martha's Vineyard, and there saw the body of a young Canada goose, fully fledged, that, according to the statement of Mr. William Day, the deputy commissioner in charge, had been killed by rats in the night. The head had been eaten off and the neck stripped of flesh. Later, the rats ate out much of the carcass, as may be seen by the illustration. In this case as well as that of the hens and turkeys at Thompson's Island, the circumstances were such that apparently no other animal than the rat could have been responsible.

Rodwell says that rats found an entrance to an aviary containing 366 birds and killed 355 of them in one night.[1]

Rats are very destructive to wild birds. A very large percentage of the eggs of bullfinches, linnets, and other small birds are said to be eaten by them in England.[2] Mr. C. H. Bradley, superintendent of The Farm and Trades School on Thompson's Island, tells me that he and his family, hearing distressed cries from a robin's nest at twilight, saw a rat that had climbed to the nest and was eating the young birds. It is a well-known fact that rats destroy the eggs and young of ground-nesting birds. Rats sometimes exterminate colonies of sea birds. A few years ago a ship was wrecked on an island off the Maine coast, which was at that time the resort and breeding place of great numbers of terns. Rats that came ashore from the wreck multiplied exceedingly and destroyed or drove away all the sea birds

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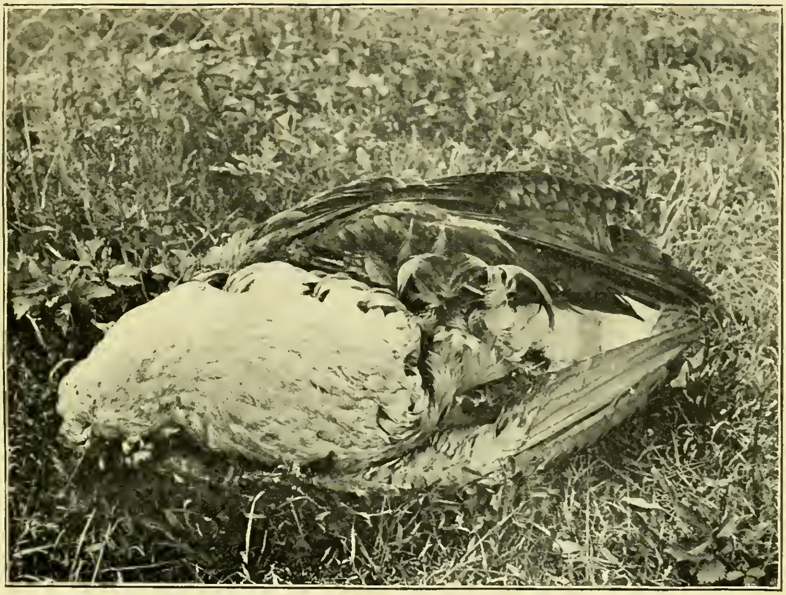
[1] Rodwell, James, The Rat, 1858, pp. 69, 70.

[2] The Spectator (London), Vol. 95, Oct. 21, 1905, p. 604.

PLATE I.



The carcass of a young Canada goose, fully fledged, killed and largely eaten by rats at the Heath Hen Reservation at Martha's Vineyard, maintained by the Massachusetts Commission on Fisheries and Game. The head had been gnawed off and the neck stripped of flesh. (Original photograph.)

breeding on the island. Many such instances have been noted on islands in various parts of the world. The rat often becomes the most serious pest of the game preserve and the zoölogical park; it destroys not only the food of birds and mammals, but the birds and their eggs and the young of mammals also. Many a gamekeeper finds rats more destructive to his young birds than hawks, owls, cats, foxes and all other so-called vermin put together.

Rat depredations are attributed often to other animals; the skunk, weasel and mink are commonly blamed when the rat is the culprit. The eggs and young of pheasants, bobwhites and ducks are its common prey. Rats sometimes kill and eat young pigs.

Dr. Brehm says that rats sometimes eat holes into the bodies of very fat swine, and that they eat the webs from between the toes of closely penned geese. Gilbert White asserts that rats ate away portions of the feet of an elephant in the London Zoölogical Gardens while the creature slept. The rats were destroyed and the elephant was put into a new house, where it recovered, but Brehm says that Hagenbeck, the dealer in animals, had three young African elephants killed by rats; the rats attacked the soles of their feet and gnawed through them.[1]

This seems almost incredible, and it is always questionable whether some of the birds and animals supposedly killed in the night were not dead or dying before they were molested by the rats. The boldness of rats, however, is well known. Craig says that they will gnaw the feet of sleeping dogs and nibble the hoofs of stabled horses.[2] This is corroborated by Kane, and recent instances of hoof gnawing are reported.

Rats confer some slight benefit on man by killing and eating rats, mice, some few insects, some carrion, offal and garbage and a great deal of sewage, but the benefits derived from rats are slight, indeed, compared with the injury that they do.

Rats damage property in many ways. They cause the decay of sills, floor timbers and floors by bringing up moist soil in contact with them, thus making conditions favorable for timber-destroying ants. They injure the timbers of buildings by gnawing them away in order to make passages into or through the walls. They sometimes even gnaw off the corners of hard bricks when such are in the way of their passage. They gnaw almost any building material except the very hardest brick, concrete, cement, glass and iron. They have been known to gnaw through zinc drain pipes and lead water and beer pipes, often causing flooding of buildings and great loss. They have compelled the manufacture of iron gas pipes, which formerly were made of softer material. There are indications that sometimes lead pipes are gnawed to secure water, but this cannot be the case with gas pipes, which are more likely to be severed when the rats attempt to enlarge the holes through which such pipes pass. They drill through flooring and plastering, undermine foundations and concrete floors, and ruin drains. They injure the planks and timbers of wooden ships, and although they are said never to gnaw through the planks so as to cause a leak, they have no doubt greatly weakened the fabric of many vessels, and perhaps have been responsible for the loss of some by water as well as by fire. They injure furniture, destroy mattresses, upholstery, matting and carpets; steal and hide in their holes jewelry and other valuable articles; destroy cloth, bagging, clothing, books, silk hosiery, silk handkerchiefs, towels, napkins and other dry goods, letters, skins of birds and mammals, felting, wills, deeds, drawings and other valuable papers; injure stored goods; eat labels off shoe boxes and other cartons, and injure packages of all kinds that are fastened with paste or glue. In a store in Washington, District of Columbia, they destroyed fifty dozen brooms worth $125. In another they broke $500 worth of fine china in a night, knocking it from the shelves. A restaurant lost $30 monthly in table linen, and a hotel $15

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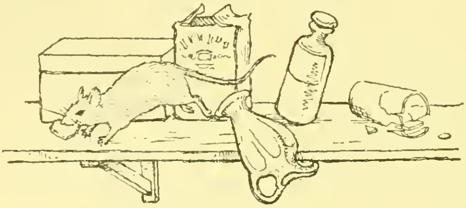
[1] Brehm, Alfred Edmund, Life of Animals, 1896, p. 334.

[2] Craig, Hugh, The Animal Kingdom, 1897, Vol. 2, p. 689.



Miscellaneous damage.

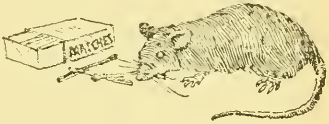
in linen in one month. They gnaw ivory, shoes, gloves, leather and rubber goods in stores; ruin harnesses; strip paper labels from canned goods, and even eat manufactured feather goods in the millinery stores. They destroy mail sacks and their contents. I talked with a clerk in a large clothing emporium who told me that the firm had employed a man regularly as a rat catcher for two years, but that rats were still so numerous that they ruined about one suit of clothes nightly.

Rats kill trees by undermining and gnawing their roots. They burrow into and undermine dams, dikes and levees, often causing breaks and serious losses. They cause much damage to all fish hatcheries and fish ponds where food fishes are artificially propagated, for there they gnaw through wooden tanks, burrow into the embankments and destroy quantities of fish which they catch and eat.

About the year 1616 rats caused a two years' famine in Bermuda. They were considered largely responsible for a famine in India following the year 1879, and became so numerous on the Island of Mauritius that the Dutch were compelled to abandon it.[1]

RAT INCENDIARISM.

Fires are attributed commonly to rats and matches. Rats are attracted by the phosphorus contained in matches, or by the paraffin in which some manufacturers of matches dip their goods. Matches have been found in rat nests, and in one case at least a nest was found which had been set fire by such a match which nearly caused a fire on Her Majesty's ship "Revenge."[2]



The incendiary.

Rats' winter nests are made commonly in buildings, between walls and near chimneys, where it is often very hot. The nests are built of dry and inflammable material. When rats take matches to these nests fire is very likely to result, either from the friction of the rats' teeth or from the heat, which readily ignites matches containing a large percentage of phosphorus.

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[1] Lantz, David E., Treas. Dept., Public Health and Marine Hospital Serv. of U. S., The Rat and its Relation to the Public Health, by various authors, 1910, p. 223.

[2] Hardwicke's Science Gossip, Vol. 5, 1869, p. 142.

It is believed that a considerable proportion of the great loss of life and property by fire in the United States is due to rats alone, for the foregoing is not by any means the only way in which they set fires. Fires in mills have been traced to the spontaneous ignition of oily rags and cotton waste carried under floors by rats and mice. Gas explosions and resultant fires have been caused by rats eating away lead pipes leading to gas meters, and human lives have been put in jeopardy through the leaking of gas from this cause even when no fire resulted. Rats often gnaw away the insulation from electric wires, and in recent years this has become probably the most fruitful cause of city fires that can be attributed to rats. Insurance companies a few years ago estimated the fire loss in the United States due to defective insulation of wires at $15,000,000 yearly, a large part of which is directly due to the depredations of rats.[1] No doubt the annual loss from this source has increased rather than diminished.

THE COST OF KEEPING RATS.

The cost of keeping rats has been variously computed. The annual upkeep per rat is estimated by the Incorporated Society for the Destruction of Vermin (British) at $1.80 in Great Britain, $1.20 in Denmark, and $1 in France.

Surgeon R. H. Creel of the United States Public Health Service estimates one-half cent a day ($1.82 a year) as a conservative figure of the cost of keeping a rat in the United States;[2] and this seems very reasonable as it barely exceeds the estimate for Great Britain. At this rate a farmer or stable keeper who keeps 50 rats loses $91 yearly, and he who maintains 100 rats loses $182 annually. It is a poor farm that cannot sustain 50 to 100 rats.

Professor Lantz says that the average quantity of grain consumed by a full-grown rat is fully two ounces a day, and that a half-grown rat eats nearly as much as an adult. If fed on grain, therefore, a rat eats 45 to 50 pounds a year, worth about 60 cents in wheat or $1.80 to $2 in oatmeal. If fed on modern "denatured" cereals in packages, such as are used in our households, the cost of maintaining a rat is greatly increased, and if fed on beefsteak, young chickens or squabs, the cost would be still greater. Hotel and restaurant keepers have estimated $5 as a conservative statement of the cost to them of keeping a rat a year. In addition to this, the injury that they do to property of other kinds is sometimes greater than that done to food supplies. Estimates of the amounts of losses from rats in foreign countries have been published. In Denmark they have been reported to amount to 15,000,000 francs, or $3,000,000 yearly. In France the total losses from rats and mice in 1904 were estimated at 200,000,000 francs, or nearly $40,000,000. The German Ministry of Agriculture states that through the agency of the rat the people of Germany suffer an annual loss of at least 200,000,000 marks or $50,000,000.

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[1] Lantz, David E., U. S. Dept. Agri., Biol. Surv. Bull. 33, 1909, p. 28.

[2] Creel, Richard H., U. S. Public Health Reports, Vol. 28, No. 27, July 4, 1913, p. 1405.

Sir James Crichton-Browne, of the English Incorporated Society for the Destruction of Vermin, asserts that the damage done by the rat to agriculture and rural communities alone in Great Britain and Ireland equals £15,000,000, or about $73,000,000 per annum. This takes no account of the injury done in towns or in connection with shipping.[1]

Professor Lantz estimates that the cities of the United States lose $35,000,000 annually from the depredations of rats. He says that if the number of rats supported by people of the United States were equal only to the number of domestic animals on the farms, the minimum cost of feeding them grain would be upwards of $100,000,000 a year. If we were to take the estimate of Surgeon Creel, that the depredations of a rat cost one-half cent each day, or $1.82 per year, and assume that there are only as many rats in the country as there are people (on the basis that the population of this country is now in round numbers 100,000,000), the rat would cost the people of the United States $182,000,000 a year. Any estimate of this kind must be largely guesswork, but a great indirect tax is not included in the above estimate, that is, the cost of the fight against the rat. No account can be had of the enormous sum paid for traps, poisons and rat catchers, the expense of fumigating steamships and rat-proofing buildings. The loss of rents is a serious item, as tenants are not infrequently driven out when rats become so numerous as to disturb their sleep and destroy their property. Professor Lantz speaks of an entire block of houses which remained untenanted for months because they were rat infested, and the owners lost yearly $2,000 in rent. I have known cases where tenants have left homes for this reason. The keeping of rats in city or country is extremely expensive from all points of view.

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[1] Lantz, David E., U. S. Dept. Agri., Biol. Surv. Bull. 33, 1909, p. 19.

All the above indictment of the rat refers only to the property that it destroys, and does not take into consideration its effect on the public health. It remains now to consider how it menaces not only man's property, but his health and his very life.

THE RAT MENACE TO HUMAN LIFE AND THE PUBLIC HEALTH.

Many accounts have been published of rats attacking human beings. A great number of such tales might be collected, but it would serve no good purpose. The old story of Bishop Hatto, who shut himself up in a stone tower to avoid the swarming rats that later found an entrance and devoured him, is perhaps one of the earliest of these tales.

There are many narratives in print regarding the death of elderly, infirm or intoxicated persons, and prisoners in dungeons, who were supposed to have been killed and partially devoured by rats; also tales of sleepers, especially infants, attacked by them and seriously injured or killed. Naturalists add to these tales. Buffon says that dying persons, prisoners and children in the cradle have been gnawed by rats. Waterton tells of a woman who was bitten on the shoulder while asleep. Jardine speaks of brown rats attacking people and mutilating infants. Buckland tells of a man attacked by rats, an infant killed by them, and the corpse of a pauper terribly mutilated by them in the morgue. Rodwell tells of children in the cradle having fingers eaten, toes, faces and necks lacerated, etc., some of whom died, apparently from the effects of such mutilation or from infection.[1] Newspaper reporters make the most of any occurrence of this nature, though usually it may have little foundation in fact. While it is true that rats will fight savagely when cornered, and may inflict infectious wounds, as I know from personal experience, the cases where they make unprovoked attacks on human beings are rare. Under some circumstances a swarm of hungry rats might attack a man in the dark, but probably most of the narratives of such occurrences are much overdrawn. Nevertheless, it is true that sleepers, particularly infants, have been bitten, and in some cases such attacks may have resulted fatally from infection carried on the teeth of the rat. This constitutes a real though rather remote danger which should be guarded against.

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[1] Rodwell, James, The Rat, 1858, pp. 52-57.

I have investigated the cases of three persons, now living, who have been bitten by rats while asleep, — one while an infant, the other two in youth. The chairman of a city board of health still bears scars on his forehead, the result of such an attack, but the most recent fatal occurrence of this kind that has come to my notice is that of a newly born infant. This child was born to Mrs. Frank W. Silver of 57 Clovelly Street, Lynn, at a hospital, on the morning of September 5, 1914. During the next night the nurse left for a time the room in which the baby lay, heard the child cry and hurrying back saw a rat jump from the bed. The infant's head was bleeding and it died at about 3 A.M. September 8. One of the Boston papers contained a long account of the occurrence, in which it asserted that District Attorney Henry C. Attwill had ordered an autopsy to determine the cause of death.

A few days later an item appeared, part of which follows: —

> LYNN, September 11. — That the death at a hospital Tuesday of the two-day-old infant of Mr. and Mrs. Frank W. Silver of 57 Clovelly Street was due to the bite of a rat was the conclusion reached to-day by Medical Examiner Magrath of Boston, who made a pathological examination of the organs of the infant. After hearing from Dr. Magrath, Medical Examiner O'Shea signed the death certificate, and attributed the death to poisoning, resulting from the rat bite.

The only error in this item seems to be the statement that the child was but two days old. It was nearly three days old.

In order to determine whether the newspaper reports were warranted by facts, I wrote to Dr. O'Shea, who kindly sent me a statement of the findings of the medical examiner at the autopsy, which showed that the child's skull had been penetrated by the rat's teeth, which had not, however, reached the brain. The internal organs examined were infected. The anatomical diagnosis was "streptococcus septicæmia." Dr. O'Shea says: —

> From the fact that the autopsy and microscopical and bacteriological examinations revealed nothing other than the presence of streptococcus sepsis to which the child's death could be attributed, together with the absolute knowledge of the rat bite, it seems reasonable to give the latter as the primary cause of death in this case.

In reply to another letter, Dr. George Burgess Magrath, medical examiner, northern district, Suffolk County, who performed the autopsy, writes as follows: —

> In reply to your letter of September 25 I beg to state that the child in question died from streptococcus septicæmia about two and a half days subsequently to infection of the scalp, presumably and evidently caused by rat bite. Although the incidence of the septicæmia was quite rapid, I have no doubt that it was in consequence of the injury specified.
>
> The term "rat poisoning," which you use, I am not familiar with; I assume it to be co-ordinate with septicæmia.

This occurrence should warn all hospital authorities to keep their premises clear of rats. I happen to know that at least one hospital is infested, and there may be others.

On the other hand, the unreasonable fear of rats exhibited by many people is ridiculous. Some women go into hysterics at the sight of a rat, and there are tales of people made temporarily insane by contact with the creatures. The bite of the rat is not always and perhaps not often infectious. In my own case it was followed by inflammation, suppuration and pain, which lasted many days, after which there was no further inconvenience.

Dr. Horder, of St. Bartholomew's Hospital, London, reported three cases of a disease, previously undescribed, which he called rat-bite fever. Having been bitten by a rat, each patient, after an incubation period of three or four weeks, suffered inflammation of the lymph channels in the tissues about the bite, accompanied by malaise, anorexia and fever. Hard, reddened patches appeared distributed over the skin, and tender swellings of the muscles. The attack lasted a few days or a week, and was followed by similar attacks at intervals of from three to ten days. These intermittent symptoms in some cases extended through several months.[1]

The most serious indictment against the rat is the destruction of human lives caused by it as a carrier of diseases fatal to mankind. The deadly bubonic plague is communicated to man mainly by the rat flea. The infection is conveyed from rat to rat, and from rat to man solely by the rat flea. The conclusions of the India Plague Commission have proved this. There is some reason to believe that certain Asiatic marmots carry the bacillus and some Asiatic and American squirrels have been infected, but the chief distributing agent is the rat. Professor Lantz states that within a dozen years there were 5,000,000 deaths from the plague in India, and in 1897 the plague destroyed 1,200,000 natives of that country. By the year 1908, the present pandemic of the disease, which started in China in 1894, had invaded every continent and secured a foothold in 51 countries. Already (1914) it has reached the United States in Hawaii, San Francisco, Seattle, Porto Rico and New Orleans. With the increase in traffic at the port of Boston, there is constant danger that it may be brought here by ship-borne rats. Probably no seaport is now safe from this pestilence, and the only known method of combating it is to isolate all patients and to extirpate rats. In the campaigns against the rat, buildings have been razed and burned, and all ships in infected ports have been fumigated to destroy rats, and many people have been engaged in hunting, trapping and poisoning them.

Germs.

This infection does not persist in the soil and a case of bubonic plague in man is not in itself infectious. The nonepidemic season is bridged over mainly by acute plague in the rat. Where there are no rats there are no rat fleas, and, therefore, there is no plague.[2]

Ptomaines.

Trichinosis among swine, a dreaded disease fatal to human life, is disseminated mainly by the rat. Trichinæ are minute internal parasites, and the only two farm animals known to be infested by them are the hog and the rat. The disease in hogs is caused by eating trichinous rats or trichinous pork. Country slaughterhouses, where rats are abundant, are among the chief sources of trichinous pork, which if not thoroughly cooked, communicates the disease to the person who eats it. Rats are subject to many intestinal worms and other internal parasites, and also to a kind of leprosy. Fatal so-called "septic pneumonia" is said to result sometimes from drinking water from wells where rats have been drowned.[1]

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[1] Treadwell, A. L., The New International Year Book, 1910, p. 622.

[2] Lantz, David E., U. S. Dept. Agri., Biol. Surv. Bull. 33, 1909, p. 31.

Rats are disseminators of the germs of many diseases, because of their habits of frequenting privies, drains and sewers for the food they find there. Ptomaines are likely to be conveyed to human food in this manner. Rats are numerous in slums and hovels where malignant and loathsome diseases flourish, and so undoubtedly they convey infections to other localities by contact with food or food receptacles. Medical men and municipal boards of health are beginning to take cognizance of the rat as a dangerous agent in the dissemination of common diseases of both children and adults, but to what extent, if any, this animal distributes the seeds of typhoid and scarlet fevers, diphtheria and other malignant diseases, remains for future study to determine.

CIRCUMSTANCES FAVORABLE TO THE MULTIPLICATION OF RATS AND THEIR APPEARANCE IN LARGE NUMBERS.

Rats can increase rapidly in numbers only under the most favorable conditions. As hereinbefore stated, a sudden influx of rats may usually be accounted for by a sudden scarcity of food somewhere, followed by migration. Rats naturally turn first to vegetable food, such as nuts and seeds. Certain seeds seem to be preferred by most rats to all other food, and wherever such nourishment is plentiful, rats multiply rapidly. Plagues of rats occur in Brazil after the bamboo blooms. This great plant matures, produces its seed and dies, at intervals of several years, and according to Mr. Herbert H. Mercer the species most abundant in Brazil lives about thirty years. The seeding is not simultaneous with all plants, but lasts about five years, more and more canes seeding each year, and each cane producing an astonishing amount of fruit, so that often the ground is covered inches deep with the fallen seed.

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[1] The Spectator (London), Vol. 95, Oct. 21, 1895, p. 604.

In 1879 Mr. Orville A. Derby found an almost universal lack of corn throughout the Province of Parana, Brazil, which was due to an invasion of rats which followed the fruiting of the canes. Each cane bears about a peck of edible seed, resembling rice, which is very nourishing. During the fruiting season the number of canes bearing seed increases each year, and the rats multiply accordingly. The last of the crop of seeds having matured and fallen to the ground, decays. The rats, suddenly deprived of food, begin to migrate and invade the plantation houses, consuming and destroying everything eatable. At corn-planting time the seed is eaten as fast as it can be put into the ground. Mr. Mercer replanted six times in one year, and finally gave up in despair. The rice crop is ruined, and everything in the houses in the way of provisions and leather is destroyed if not carefully guarded in rat-proof receptacles.[1] Similar plagues of rats occur in Chili, where the cane fruits in the same manner;[2] also in Ceylon, following the flowering and death of tropical underwoods, which fruit in the same way as the cane, but about every seven years. The rats afterward attack coffee plantations and prove very destructive.[3]

Grain growing offers a similar attractive food supply for rats. They can live in the fields in summer and fall, storing up a certain supply of food in their burrows for winter. In open or southern winters they can pick up much waste grain. In the north, their sudden appearance in large numbers in November or December may be due to the approach of winter, which drives many into farm buildings or into villages and cities. Farms with accumulations of rubbish under, in and about the buildings harbor rats by the hundred in winter, and hay and grain stored in the barns too often furnish them such a liberal supply of food that they may breed in any month of the year. A sudden local appearance of rats in numbers often is due to energetic measures taken by some neighbor to rid his premises of rats. He who has large numbers on his premises must recognize the fact that the rats are there because either he or his neighbors feed and protect them. If rats come to you in preference to your neighbor it is because you feed them more and treat them better than he does.

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[1] Nature, Vol. 20, May 15, 1879, p. 65.

[2] *Ibid.*, Vol. 20, Oct. 2, 1879, p. 530.

[3] *Ibid.*, Vol. 20, July 17, 1879, p. 266.

RAT RIDDANCE.

There is no royal, easy and immediate road to rat riddance. It requires continuous mental and physical exertion to banish the rat, but it can be done, and a reasonable expenditure to that end is a wise economy. Extermination is too much to hope for, and banishment from large areas cannot be expected without great co-operative effort, but the individual can clear his premises of rats provided the conditions are first made right. The means for ridding premises of rats may be outlined as follows: —

(1) Rat eviction: (*a*) destroying rat habitations and harboring places; (*b*) rat-proofing buildings.

(2) Rat starvation: (*a*) disposal of edible garbage and refuse; (*b*) rat-proofing receptacles for all sorts of edible materials.

(3) Rat slaughter: (*a*) traps; (*b*) poisons, chemical and biological; (*c*) shooting, clubbing, drowning, etc.; (*d*) encouraging natural enemies — owls, dogs, ferrets, cats, etc.

(4) Rat driving and harrying.

(5) Preventing rat multiplication: (*a*) all the above.

Not all of these methods are necessary in every case, but all are useful under certain circumstances. Methods of permanent eviction come first, as it is of little use to extirpate rats and then invite others to come in by continuing favorable conditions, such as a plentiful, accessible supply of food and numerous excellent breeding places.

Rat Eviction.

Those who deprive rats of nesting places, food and drink will evict them, for this prevents breeding, and rats will not stay long where they cannot eat and drink.

PLATE II.

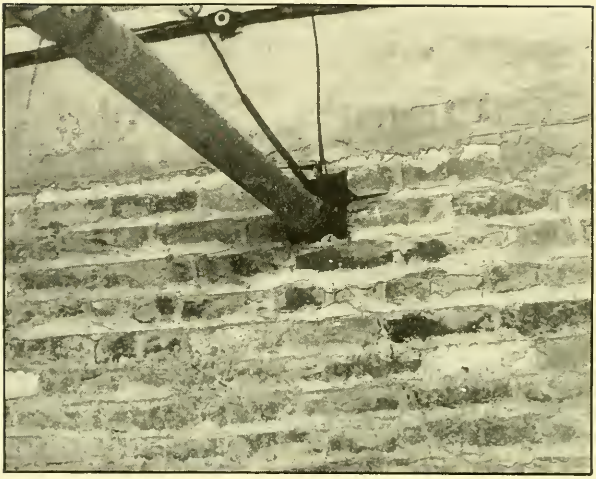

Fig. 1.— Defective and Broken Wall.

Entrance made for water pipes; should be repaired with cement the full depth of the wall. (From Public Health Reports, April 11, 1913.)

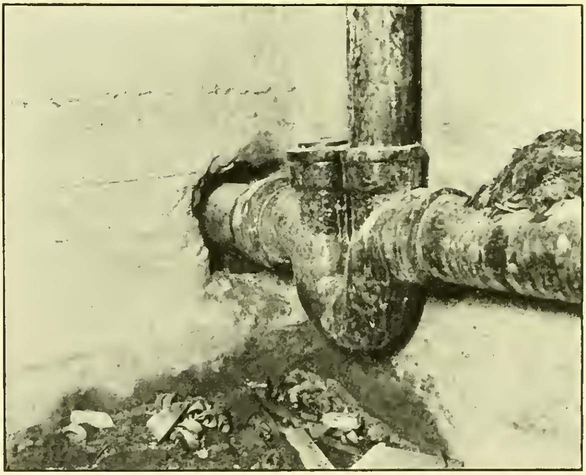

Fig. 2.— Defective Basement Wall (Opening made for the Installation of House Sewage System).

Opening left around sewer pipe and not subsequently closed. A convenient entrance for rats: should be closed with cement. (From Public Health Reports, April 11, 1913.)

Destroying Rat Habitations and Harboring Places.

Outdoor rubbish and woodpiles give rats the best possible protection by hiding and covering the entrances to their burrows or nests, so that nothing larger than a rat can get at them. Any hole in which quantities of tin cans and rubbish have been dumped is almost sure to be frequented by rats. Public dumps and the neighborhood of such places are certain to be infested by them. A general clearing up, which is sanitary and commendable for many reasons, is a necessary preparation for a rat campaign. Rubbish, garbage, etc., should be burned. Wood should not be piled on the ground in or near buildings. All rat holes in cellar or foundation walls should be treated with unslaked lime or chloride of lime and then stopped with a mixture of cement, sand and broken glass, in which glass predominates.

Rat-proofing Buildings.

Improved building construction is most important; it is expensive, but will pay in the end by doing away with most of the annual loss due to the depredations of rats in buildings.

A grocer in a Massachusetts town complained to his landlord of the injury to his stock caused by rats, and asked to have the building rat-proofed. The landlord replied that he could not afford it, but would pay the cost of the stock destroyed by rats in the store each month. At the end of the first month the grocer presented a bill for $25. The landlord made some forcible remarks and doubted the loss. He was shown the ruined goods, and decided that it would pay to rat-proof the building. When this had been done the rats remaining in the building were destroyed by phosphorus, and the grocer has had little trouble from rats for years.

Stone or brick walls as underpinning will shut out rats if all crevices can be stopped with good cement mortar, but concrete or reinforced concrete is the best material for rat-proof construction. City ordinances everywhere should require such construction in the cellars and foundations of all dwelling houses and business blocks, and tenants should everywhere demand it as a protection against disease and the destruction of property. When buildings are under construction the additional cost of rat-proofing is slight indeed in comparison with the advantage gained. Cellar walls, if made of stone, should be laid in concrete, and the cellar or basement floor should be of medium concrete 3 inches thick overlaid with cement. Such floors will be better drained and will not be undermined by rats if 8 or 10 inches of gravel can be put in as a foundation and the concrete laid upon it. If, then, the walls on which the sills of the house rest are of brick, stone or concrete, rising 2 feet or more above the ground, and the doors, windows and other openings are well protected, there will be little chance for rats to gain access to the building. A rat must have some shelter and something to stand on to gnaw through the wooden wall of a house. A veranda sometimes offers such an opportunity, as the rats may find some support beneath it from which they may penetrate the wall. Verandas and walks should be made of concrete or similar material laid on gravel, with side walls extending at least 2½ feet under ground. Plank walks furnish excellent accommodations for rats and should be done away with. As an additional safeguard the walls of the house above the sills may be filled with cement up to about 2 feet above the floor. This will prevent rats burrowing into the wall. If upper windows are left open, and unscreened, rats may enter them by way of trees near the house or vines climbing upon it. If rats gnaw the doors all outer doors should be provided with metal strips 6 inches wide at the bottom, and each outer door or screen door should have a spring or check device to keep it closed. Cellar windows, skylights and ventilators should be screened with galvanized wire netting of half-inch mesh and not less than 20 gauge. Any unused chimney should have all openings closed with tight-fitting covers and the top screened. Traps that rats cannot crawl through should be used in all water-closets; otherwise they may enter the house from the sewer. All holes where pipes pass through cellar walls should be closed with concrete. In large storehouses or warehouses, particularly those without cellars, it is a great advantage to make the lower floor of reinforced concrete. In stores or dwelling houses where this cannot be used solid concrete walls and a double floor with 1½-inch mesh wire netting of not less than 20 gauge nailed

PLATE III.

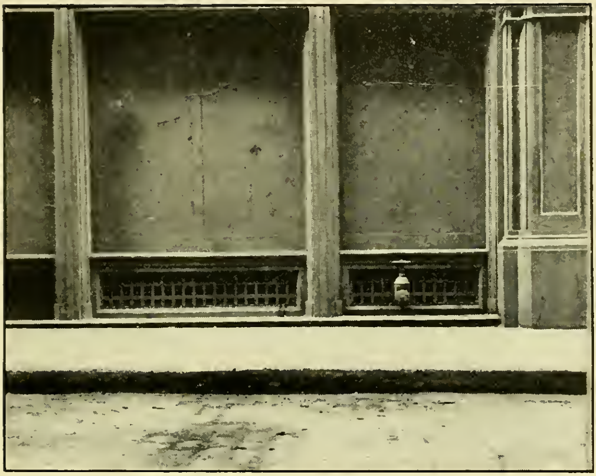

Fig. 1. — Unscreened Basement Ventilator.

Rats enter basements from the street through such openings. They should be covered with wire-mesh screen. (From Public Health Reports, April 11, 1913.)

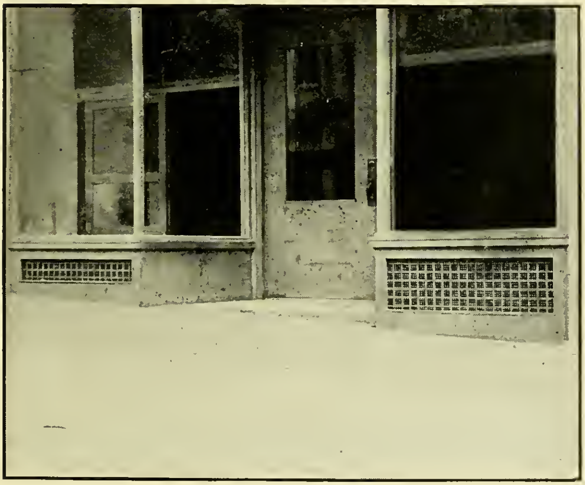

Fig. 2. — Rat Screens.

Properly screened basement ventilators under show windows. (From Public Health Reports, April 11, 1913.)

between the floors and extending up 8 inches under mopboards and casings will suffice.

Nothing harbors rats in town or country like the barn, shed or other building with timbers laid on the ground or near it, with just space underneath to accommodate rats and exclude dogs and cats. Small ricks or buildings, such as corn barns, henhouses, woodsheds, etc., may be made rat-proof by setting them up on posts at least 2 feet from the ground (3 feet is better), provided there are no lumber or rubbish piles, trees, chicken ways, etc., by which rats may gain access to the building. Dogs, cats, skunks, weasels and other natural enemies of rats can pass freely beneath such buildings, and will make life unpleasant for the rodents there. There should be no projection of post or beam to which the rat can climb and on which he can stand and gnaw through the floor above.[1] The New England corn barn, standing on four high posts, capped by inverted milk pans and reached only by a ladder, is effective, but its usefulness is too often minimized by lumber, rubbish or other material lying or leaning against it, and forming a bridge or ladder on which rats may enter. A building lined with wire netting of one-half inch mesh and 20 gauge, such as is used for screening cellar windows, is thus protected against rats, mice, squirrels or birds. Henhouses and brooder houses usually are built on the ground, or on posts set into it, with board or dirt floors. Some poultrymen use inch mesh chicken wire netting to keep out rats, digging a trench 2½ feet deep around the building, and burying the wire netting upright in this, having first attached the upper end to the sills. I have used this wire with good results, but only when the small doors leading out into the yards were at least 24 inches from the ground, and when the fowls were not furnished gang-planks to walk out on, but were obliged to fly up to the entrances. Mice and small rats, however, will readily pass through this netting, and half-inch mesh is better. In rare instances rats dig under such a 30-inch netting and it should extend 36 inches under ground. The plan used on some game preserves may be better for pens. About a foot of netting is laid on the ground, extending out, not in, from the base of a wire fence or building. It is said that all predatory animals try to burrow close to the wall or fence, and finding the wire desist. Concrete foundations and floors combined with the use of fine mesh netting to cover all openings may be recommended as the surest way of rat-proofing poultry houses. A foundation wall should first be provided, extending at least 1 foot under ground (3 feet would be better) and 1 foot above it. If the wall is slightly wider at the bottom than at the surface it will better withstand the heaving of frost. At least 8 inches of gravel may be laid on the ground under the floors inside the walls to insure good drainage. If the sills of the building are then laid on the walls, rats cannot reach the sills to gnaw through, and they cannot burrow under the floor and undermine it.

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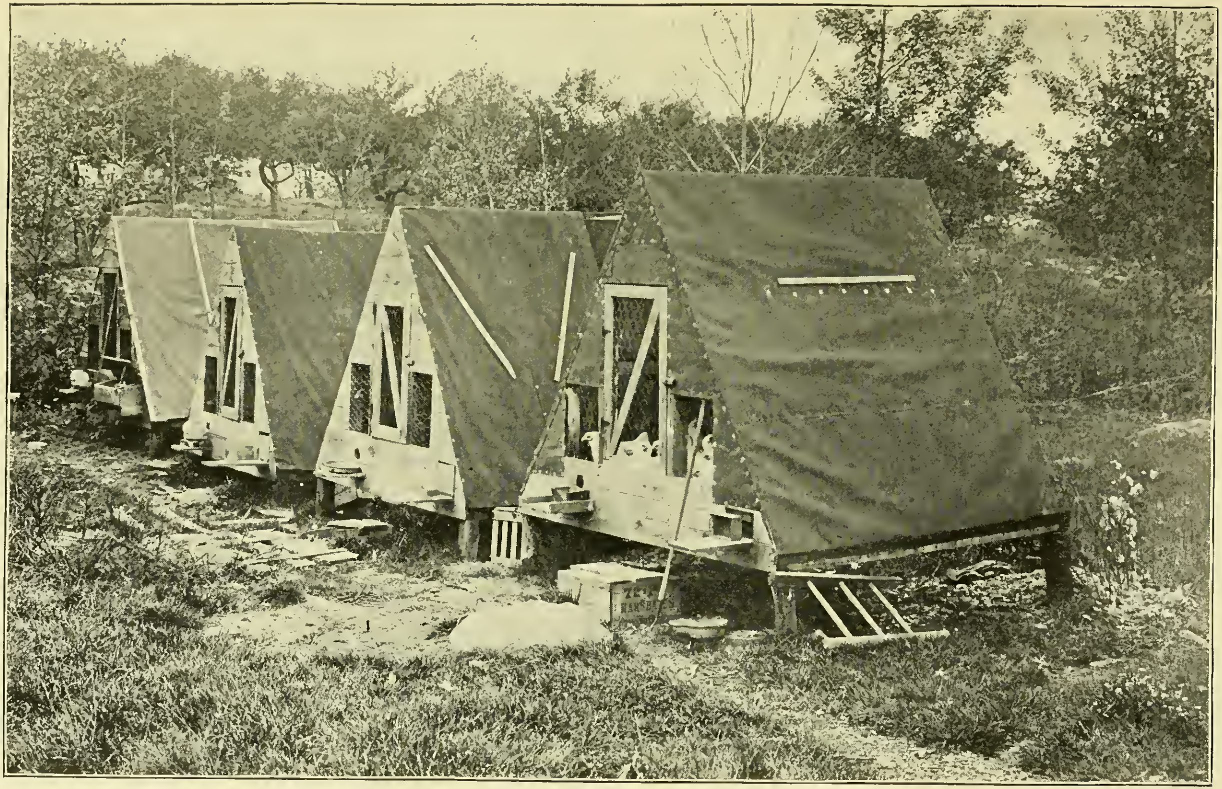
[1] Poultry houses thus raised are free from dampness, but expert poultrymen do not recommend them for winter use in New England.

A poultryman recently concreted the floor of his henhouse, but allowed the sills to rest on the ground. Immediately rats gnawed through the heavy spruce sill and tunneled under the concrete, working through it before it had hardened, entering as freely as before.

Dr. R. H. Creel says that chicken pens can be protected by concrete walls extending down 2 feet or more into the ground with half-inch mesh wire netting covering the sides and tops of the pens. This will prevent rats, mice and sparrows from getting in and will protect chickens against cats, hawks and other enemies. Fowls should be fed always in rat-proof houses, sheds or pens, never in open yards. In this way the great loss which ordinarily occurs in feeding rats, mice and English sparrows will be avoided. Open-front henhouses or scratching sheds should be covered with half-inch wire netting in order to keep rats from climbing in through the wire. Pigeon lofts should be similarly protected. No opening must be left anywhere unguarded. A gentleman in Milton, Massachusetts, found it impossible to raise squabs on account of the depredations of rats, which, notwithstanding he had wired his pigeon loft, continued to kill pigeons and squabs, although the only opening was a window about 20 feet from the ground. It was suggested that he put a wide sheet of zinc around the window. This proved effective, stopping the entrance of both rats and squirrels, as they could not climb up or over it. It is difficult to keep rats out of barns and stables where doors are constantly left open, but something may be done.

PLATE IV.



Rat-proof Henhouses of Herbert Thayer, Harvard, Massachusetts.

This shows raised form of construction. Rats have never troubled these henhouses, but they would be better if raised higher from the ground and if the boxes, ladder, etc., which might give access to the rats were removed. These henhouses were not raised by the owner for the purpose of rendering them rat-proof, but to keep the hens off the damp ground. (Photograph by E. I. Farrington.)

Concrete barn cellars will help to prevent rats from harboring in barns. Horse manure might be kept in a concrete pit with a cellar wire screen or a close cover over the top. Cow manure will not interest rats unless grain, straw or some similar food is mixed with it. All wells, water tanks, etc., should be rat-proofed, for rats must have water.

Rat Starvation.

Separating rats from their food will drive them away if no other method is resorted to. Where food is plentiful and easily obtained it is difficult to trap or poison rats. Starvation, then, increases the effectiveness of trapping and poisoning.

Disposal of Edible Garbage and Refuse.

All garbage should be placed in covered rat-proof cans and kept covered. It should be burned or disposed of where rats cannot get it. If manufacturing concerns and business houses allow their employees to lunch in the buildings, all remains of lunches should be carefully disposed of. When thrown into waste baskets, on floors or even outside the building, such crumbs and pieces will feed many rats and mice daily, and perhaps neutralize well-directed attempts to rid the premises of the vermin.

Rat-proofing Food Receptacles.

All rooms in which food is kept should be rat-proofed with concrete, sheet metal or cellar wire netting, or all food should be kept in receptacles made of or lined with these or similar materials.

If horse mangers were built 18 to 24 inches deep, to prevent horses from wasting and scattering grain, and were set at least 2 feet away from the walls and entirely unconnected with them, a favorite food supply of the rat would be cut off. The ordinary shallow manger built against the wall seems designed for the express purpose of feeding rats and wasting grain. Hog troughs should be deep. Care should be taken not to spill and scatter grain in feeding.

Closely covered concrete vaults will keep rats out of privies.

If the rules above given were followed universally, rats would be noticeable only for their scarcity, and the rest of this bulletin would be useful only to farmers who have rats in their barns and fields.

RAT SLAUGHTER.

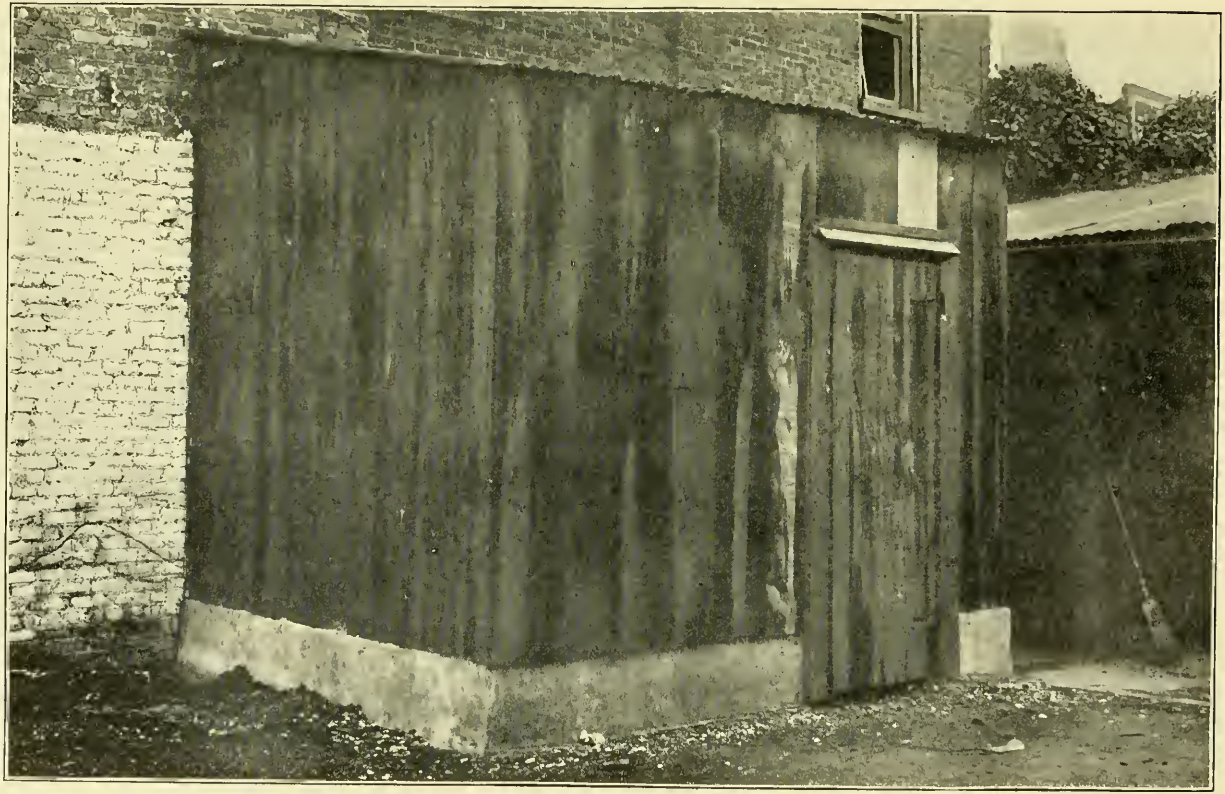
However thorough we may be in evicting and starving rats there always will be careless or indolent neighbors who will furnish them food and good breeding places, and so perpetuate and increase the species that we shall have to take care of the overflow. Occasionally rats will get into a rat-proof building through a door or window carelessly left open, and most farmers have rats in their barns or outbuildings recurrently, or constantly. Hence the necessity for continuous rat persecution and destruction. A little rat catching now and then has no appreciable effect. Rat slaughter is the only term that describes effective work.

For centuries the rat has been under the ban. Every expedient and contrivance that the inventive genius of man could devise for rat destruction has been utilized. It is not probable, therefore, that any new methods will be found in this bulletin, and if those here recommended have any merit, it will be because of precise detailed directions based on practical experience.

Rat Trapping.

Effective traps rate high among the means of destroying rats, and if used persistently and with judgment, in connection with a proper safeguarding of food supplies, many a home or farm may be cleared of rats by traps alone. An early experience convinced me of this. As a boy of fifteen, while attending a country seminary, I lived one winter with my aged grandparents on a small Massachusetts farm. They kept two overgrown cats, which never caught a rat, and the house so swarmed with the rodents that they sometimes disturbed our slumber by running over our faces, and even ate a hole in my bed. Henhouse, pigpen, woodshed, stable and barn all had their quota of rats, both black and brown, for at that time the black rat was still common in Massachusetts. An attempt to catch a rat in a steel trap resulted in the capture of one of the cats, so the cats were killed and a trapping campaign com-

PLATE V.



Rat-proof Shed.

Concrete foundation extending two feet into the ground and one foot above floor level. Concrete floor, roof covered with corrugated iron. (From a photograph by Dr. William Colby Rucker of the United States Public Health and Marine Hospital Service.)

menced. Having to attend to my studies, saw and split the winter's wood, do the chores in house and barn, and some cooking, churning, etc., I might have been considered fairly busy for a boy of fifteen, as boys go nowadays, but the rat catching devolved upon me and was my only pastime. There was but one trap, a rusty steel concern, used for woodchucks, but numbers of deadfalls and other contrivances, including mouse traps, were fashioned by candlelight and firelight, and from cellar to garret and from pigpen to haymow the number of destructive contraptions grew apace.

Pantry and grain bin were closed securely to starve out the rats and drive them to the traps, where a variety of bait was offered, but they still found some food about the barn, pigpen and henhouse. Soon, nevertheless, we were awakened at night, not by rats running over our faces, but by the bang of deadfalls loaded with bricks as the unsuspecting victims were crushed beneath them. At the end of the second month neither rat nor mouse, nor a sign of either, could be found about the house or any of the farm buildings. Thus I learned by observation and experience that it was possible to rid the farm of rats by traps alone, by taking a little time every evening for trapping. Patient, persistent trapping succeeded where cats had failed utterly, and no particular pains were taken to disguise or conceal the traps.

It is not always so easy to trap the rats on a farm as it was in this case, and some city rats are not so unsophisticated as were their country cousins in those days, but with conditions made right, traps may be used with great success.

The ingenuity of man having been exercised for many years in inventing rat traps, numerous designs have been perfected, most of which are effective, — if the rats can be enticed into them. "There is the rub." Box traps open at one end or both ends, figure 4 traps, and many others of the deadfall type, steel traps and gins, tin box traps, wire cage traps, traps with pitfalls and trap doors, traps with mirrors to entice the foolish rat to his downfall, traps for drowning, guillotining, hanging and electrocuting rats, torture traps, humane traps and many others have been put on the market, but success depends more upon the trapper than upon the trap. One man will set a trap, keep it set for weeks, and catch nothing; another will take the same trap, and by handling and setting it in a skillful manner make a catch the first or second night. There are three types of trap easily obtained, all of which are successful if properly handled, and although I have tried many others experimentally, it never has been necessary to use more than these to clean out the rats, provided conditions have been first made favorable for their use. Often in such a case one style of trap will suffice.

Some rats may be taken by traps where food is plentiful and easily accessible, but trapping will be much more effective if they are deprived of all other food than that offered in or about the traps. Dr. Creel mentions a case where an experienced trapper set traps in and around a bakery for two weeks, changing his bait from time to time, but each morning his traps were ratless. Cheese, bacon, meat, vegetables, flour, nuts and other attractive baits were used unavailingly; but later, when the baker moved out and the rats had eaten all the loose flour and food remaining, more than 30 rats were trapped in a morning and in four days 80 were taken. "Traps or poisons," Dr. Creel says, "placed in the neighborhood of an overflowing garbage pail, in a pantry with open bins and exposed food, or in groceries and warehouses having foodstuffs spilled over the floor, will only result in wasted endeavor." [1]

In a general way this is true; still, I have taken rats by both traps and poisons in a large barn where grain bins were open and where grain lay half an inch deep under the straw on the floors of the lofts, and have seen eight rats caught, one each night for eight nights, in a single trap set in a grocery where they could easily obtain a variety of food, but it would be very difficult, if not impossible, to clear premises of rats under such conditions. Where rats are very suspicious one of the first requisites in successful trapping is first to treat them well for a time and feed them well, so that they will feel at home and become confident and careless; then set many traps, taking away all other food than that in or near the traps. Rat-hunting dogs and cats are a detriment to the trapper, as they frighten the rats so that they become cautious and suspicious.

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[1] Creel, Richard H., Public Health Reports, Vol. 28, No. 27, July 4, 1913, pp. 1407, 1408.

Also, dogs or cats are likely to get into traps and carry them off, or to carry off captive rats, traps and all or to steal the bait. Hence, it is best to use traps only in buildings, boxes or other receptacles where dogs, cats and chickens can be shut out. In outdoor trapping, wild birds may be caught, unless the traps are concealed in boxes, holes or trenches. When dogs and cats and food other than that in the traps have been disposed of, trapping may be undertaken with a certainty of success.

Snap Traps. — The time-honored snap trap, which has been used by fur trappers for generations, is the steel trap. This is a good rat trap if properly set and concealed, but it is a cruel and inhuman machine unless used in such a manner as to kill the victim at once. As ordinarily set, without any precaution, it may now and then get a rat, particularly in grocery or provision stores, where food supplies are handled much. If a number of traps are kept constantly set so as to spring at a very light touch, and placed in rat runways or next the walls behind barrels or packing cases, a rat may now and then blunder into one, even if it is not baited. Sometimes unbaited traps are most successful, especially when the rats have become suspicious of baited traps. Rats may in time become so heedless of unbaited traps as to get caught, for the trap is far more patient than the rat; it can always afford to wait, and the rat is often necessarily in a hurry.

He who does not care to go to the trouble of covering or disguising his traps may succeed by first setting a number, baited, with the jaws open and the springs bound down by fine wire so that the traps cannot snap. The bait — bacon or strong toasted cheese — may be hung over the pan or tied to it. Fine sand or meal may be kept strewn about the traps for several days, and when the bait is taken nightly, and tracks in the meal or sand show that the rats have learned to run over the traps freely, the wire may be removed and the traps carefully set and baited. Some success has followed hanging the bait over the pan, but it is a cruel expedient as the rat is commonly caught alive by one leg.

No trap is more effective than the "break-back" or guillotine trap, provided with a wire fall, driven by a coiled wire spring and sprung by a trigger, baited or unbaited, as seems best under different circumstances. (See Plates VI. and VII.) These traps are as humane as any, for (if set with circumspection) they usually catch the rat by the head, neck or back, killing it immediately. Occasionally, however, a rat will be caught by the leg, and will go off with the trap. For this reason all snap traps when set should be fastened to some heavy object or to the building by wire or cord. Sometimes the trap will be found sprung, but ratless. In such a case a mouse may be the culprit, and the trap, being too large for mice, springs over and past it. Sometimes the rat, coming in from the back of the trap, is missed or thrown off by the spring, and other times he is hit on the head by the trap but not held, and may be found dead not far away. A rat catcher explains this by the assertion that certain "wise old rats" reach in from the front or side and spring the trap by a quick side cuff, getting away as the trap springs, and that occasionally one is not quick enough and is caught by the fore paw or hit on the head. I am inclined to doubt this explanation.

Probably the metal trap (Plate VII., Fig. 2) is best, as it is durable and will not absorb and retain odors so readily as will the wooden traps. This trap and the similar wood and wire trap (Plate VI., Fig. 2, lower left) may best be set in a very dark place or corner, behind some box or chest, as it is impracticable to conceal it. The wooden-backed trap is effective, as the rat cannot enter it from the back and so avoid the wire. If either of these upright traps is set with the back too close to the wall the wire release will strike the wall when the trap springs, throwing the trap forward, but it usually gets the rat.

The flat trap (Plate VI., Fig. 2, upper figures), which can be obtained for ten cents at the five and ten cent stores, is not quite so strongly made as the others, and occasionally a large rat will get out of it, but it may be relied upon to clear a house or store of rats if sufficient numbers are properly baited, set and concealed, and if the rats are deprived of food other than that furnished them at the traps. This trap may be easily disguised and hidden, but it has the disadvantage that the rat may come and get the bait from the back, and may thus escape the blow of the trap either by crawling

PLATE VI.

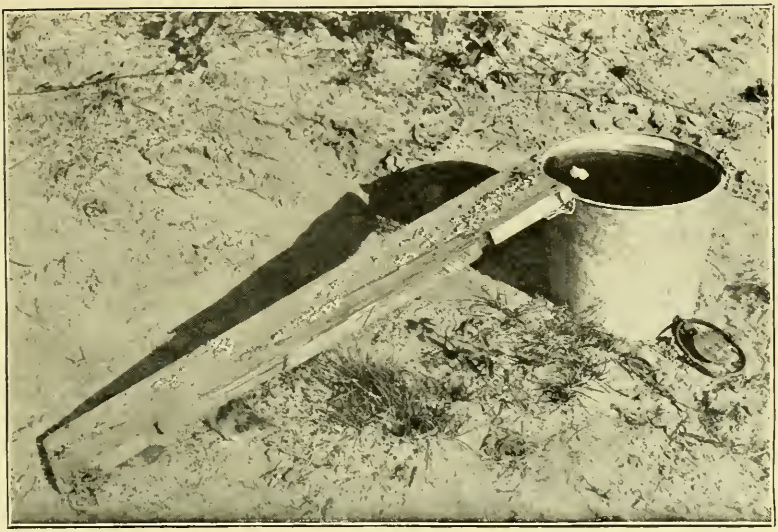


Fig. 1.— Trap set under water to deceive the experienced rat. This can be used most successfully in dark closets, attics or cellars. See page 211. (Original photograph.)

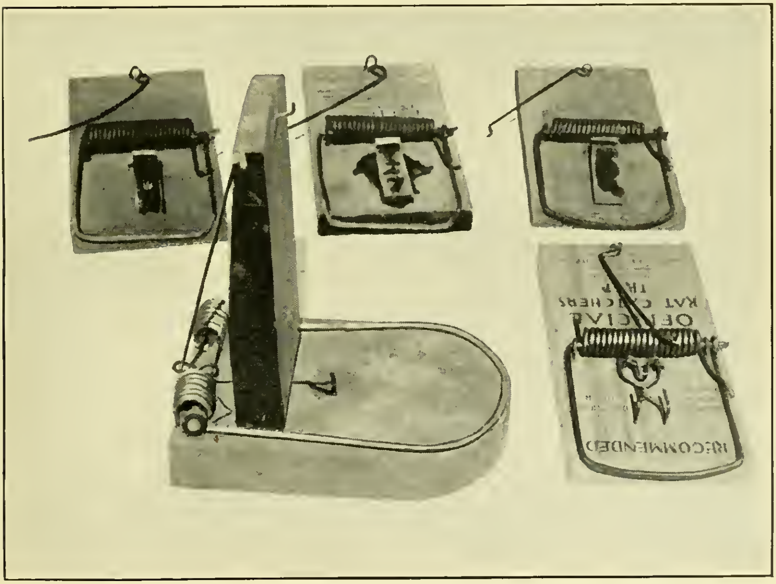
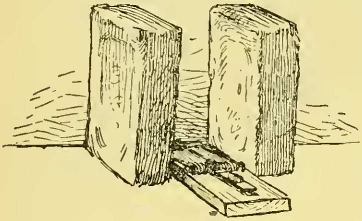
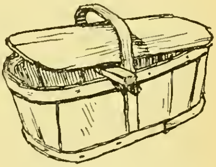

OFFICIAL
RAT CATCHERS
TRAP
RECOMMENDED

Fig. 2.— Different makes of the snap trap, all of which are effective, but the official trap — lower right — probably is best. (Original photograph.)

beneath the wire as he enters (I have seen a small rat do this), by crouching within the sweep of the wire so that it passes over without touching him or by being thrown off by the wire as it rises. Occasionally a rat will be found trapped that has been thrown in this way but carried clear over and caught on its back with its feet in the air. If the trap is set against a wall, with some obstruction like a brick set on either side, so that the rat cannot pass between the bricks and the wall, it is likely to run around to the front of the trap and so entering be caught (see cut); or the trap may be set so that it leans diagonally against the wall between two upright bricks in some dark corner, or even hung upon the wall an inch or two from the floor. It is not practicable to conceal it if hung up, but if so hung in some dark closet it may now and then get a rat. Another plan is to enclose the trap in a box with a hole placed so that the rat going in will come on the trap from the front, or the trap may be set in a covered grape basket, giving the rat room to enter only at the front under the raised cover. (See cut.)



Trap arranged for front entrance. The trap should be covered with chaff.



Grape basket with trap concealed inside.

The flat trap, different makes of which are shown on Plate VI., has been used mainly in the trapping experiments undertaken by the State Board of Agriculture, chiefly because it is inexpensive. One reason why many people have little success in trapping is *that they do not use traps enough.* Where rats are numerous 25 to 50 traps should be set, so that a considerable number of rats may be caught *at first,* before the alarm has spread. Every ten-cent trap that catches a rat saves the owner many times its cost. Rarely a single trap, carefully set, may catch a rat every night for a short time, but where rats are numerous they soon take the alarm, and one trap will not get enough in the end to keep pace with their increase.

A similar trap is the "official" (Plate VI., Fig. 2, lower right), used by the United States government in its rat extermination work. This costs more than the other flat traps, but the advantage is claimed for it that the rat can spring it by either raising or lowering the trigger; also it has less wood in its construction than the other, which better fits it for outdoor use, and is more strongly made.

Exposure to rain and snow eventually will spoil any trap of this type, as rust will weaken the springs, while wetting and drying may cause the wood to split, but the official trap will stand a season's exposure to the elements.

Cleaning, Disguising, Scenting and Concealing Traps. — It is well known that trappers use scented baits to lure animals to their traps, and there is many a "secret" of the professional trapper that is supposed to insure success. Some of these lures are useful, among them strong-smelling foods the odor of which readily can be perceived from a distance by all wild animals.

Certain other scents, like musk, anise and catnip, are known to attract certain animals. In the days when rat-baiting was a common pastime, and when the rat pit was almost as much a national institution in England as the bull ring still is in Spain, rat catching was a thriving trade, and professional rat catchers of that day were firm believers in the use of scents for attracting rats. The experiments made by the Massachusetts State Board of Agriculture seem to prove that certain scents are attractive to some rats, but it is possible that these odors serve more to disguise the smell of the trap than to lure the rats. When the trap gives off an odor of iron rust, rat blood or human perspiration, no doubt the experienced rat takes the alarm. Therefore the expert rat catcher cleans the trap, disguises the odor or substitutes some strong odor for it. Whatever the reason, the scented traps caught more rats than those unscented. While trapping for three days in two barns with cleaned, covered and scented traps, handled with clean or scented gloves, we caught twenty-three rats. Three days' trapping with uncovered and unscented traps secured but three. To get the best results traps should be handled only with gloves and with great care and gentleness. Throwing or kicking the traps about is likely to put some of them out of action. The leather gloves used in trapping should not be handled, should

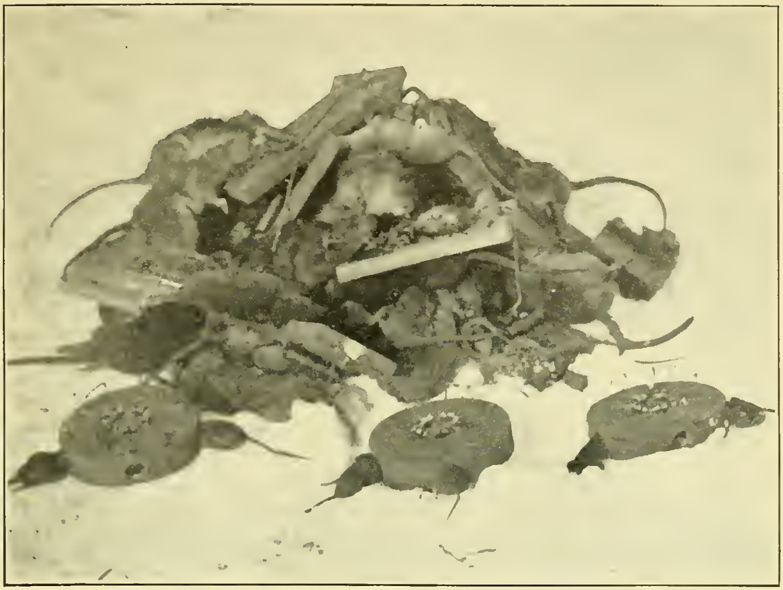


FIG. 1.—CARE PAYS IN TRAPPING.

Twenty-three rats trapped in two barns in a few days by clean, scented and concealed 10-cent traps, with a few mice taken incidentally. Trapping with uncovered and unclean traps yielded only three rats in the same buildings. See page 208. (Original photograph.)

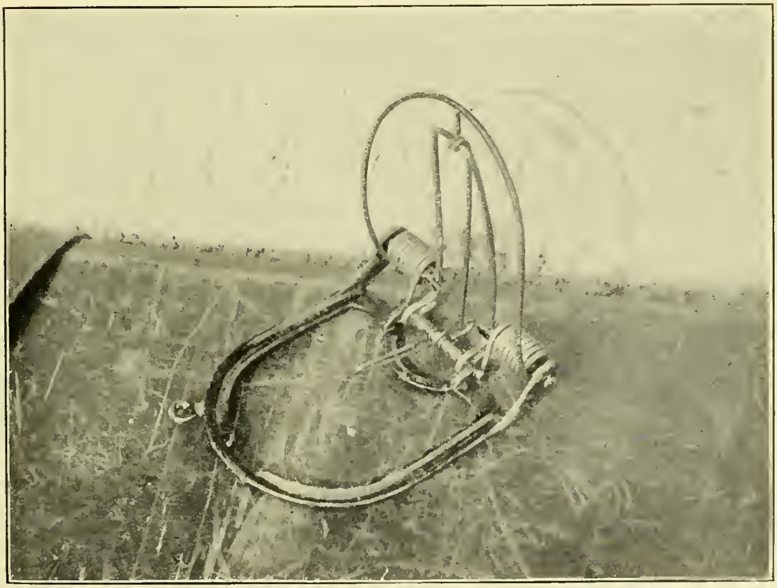


FIG. 2.—THE SCHUYLER TRAP.

Metal traps like this are very durable and effective. (Original photograph.)

be kept as clean as possible and should be scented with a drop or two of the oils of anise, caraway or rhodium which have been proved efficient in overcoming human scent. Traps should be well cleaned, before setting, with plenty of water and a brush (or scalded), and dried before a fire. In scenting the bait, a *single* drop of oil of anise or caraway is dropped on a piece of paper, and this paper rubbed on the bait. This may be used for several traps. More is unnecessary and may repel the rats. Where gloves are not at hand the following procedure is recommended by rat catchers: —

Take a large handful of oatmeal; drop on it four drops of oil of caraway or anise; rub it through the hands until the oil is well mixed with the oatmeal, and continue to do this occasionally while handling and arranging the traps. This is intended to take up the perspiration and disguise the odor of the hands. Rat catchers in olden times were accustomed to make a trail from trap to trap by dragging from a fishing rod a herring, a rag scented with oil of caraway and another, or a calf's tail, scented with the oil of anise. The soles of the trappers' boots were anointed. Trappers also used mixtures of various oils for drawing rats, among which were the oil of rhodium, oil of lavender and "oil of rats," which, as its name implies, was tried out of the rats themselves.[1]

Where one scent is not successful, or the rats learn to associate it with the trap, another may be tried, or the traps may be washed and smoked. Such precautions may not be necessary in a grocery store or a bakery, or wherever the food is handled constantly and the human odor is over everything, but, ordinarily, traps will give best service if cleaned and concealed. Steel traps or flat traps may be covered with chaff, bran, cut hay, sawdust, feathers or dry earth. When a trap is covered with bran or chaff the material should be strewn over a considerably larger space than the trap covers. Two or three traps may be set near together, but they should not be set so near that one in springing will spring another by striking or jarring it. When a steel trap or a guillotine trap is set in meal, shorts or earth, a bit of some light fluffy substance, like cotton, should be placed under the trigger or pan before it is covered. This will prevent the covering material from getting under the pan and packing so as to stop the trap from springing.

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[1] Rodwell, James, The Rat, London, 1850, pp. 249-251.

A trap should be set so gently that it will spring at the least pressure on pan or trigger. In setting, the fingers should not be used to depress the pan; a rolled-up paper wears better, and if the trap springs on it, it will not bend the wire.

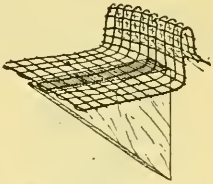
Catching the Experienced Rat. — Every one who has trapped rats knows that sometimes after most of the rats in a building have been caught there remain a few cautious old rascals that successfully defeat all efforts to entrap them. These may be taken without great difficulty if their food supply, other than that furnished by the traps, can be *completely* shut off, otherwise they may continue to defy all efforts to take them, but if the trapper is persevering they will be captured or driven away in time.

The steel trap (if covered and its odor disguised or concealed) is one of the best devices with which to deceive rats. Some experienced rats are almost as cunning as a fox. Indeed, some of them are so much wiser in their way than most people who attempt to trap them that trapping often is given up in disgust.

A close study of the habits of the rat is necessary for successful trapping. The trapper should remember that the rat always goes barefoot. When a cautious rat, in its nocturnal rambles in search of food and led by delectable odors, places its bare foot on cold, clammy iron or steel, the touch no doubt strikes a chill to its very marrow and raises an instant alarm. Also, if the trap is fully exposed to view it may arouse the rat's suspicions before dark. Hence the rat catcher covers the trap.

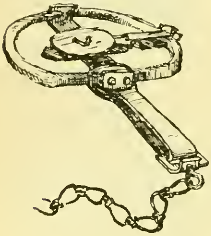
When the steel trap can be set under water it gives out no odor, and if the rat cannot see it readily, particularly at night, he is easily caught and drowned at once, which puts an end to his suffering. The trap may be set on a stone or a clod under water, and the bait may be attached to the pan so as to show above water. When the trap springs, the rat, caught by the head, springs with it, goes into deep water and is held down by the trap and drowned. A trap set under water in a little run leading into a fish hatchery pond caught a rat every night for nearly two weeks.

Sometimes an "educated" house rat defies all efforts to entice him into a trap. In such a case the following plan often succeeds: take a large pail or firkin (if there is danger of leakage a galvanized iron bucket is best) and a piece of cellar wire netting about 4 inches wide by 8 inches long. Bend the netting so that it will hang over the edge of the pail and form a shelf inside parallel to the bottom of the pail and about 2 inches from the top. A triangular piece of wood may be nailed under the shelf as a bracket to support it, so that it will hold the weight of both trap and rat. (See cut.) The trap may be dipped in melted wax to keep it from rusting, and set on the shelf with the bait tied to the pan. The pail should be set in some dark, unfrequented spot in attic, closet or cellar, where the rats run, and filled with water so as to just cover the trap and pan but not the bait. I have used a thin chip, tied on top of the pan, on which the bait was fastened to keep it dry. The bait must be handled only with clean gloves. The pail should then be nearly or quite full. Now a board is laid from the floor to the top of the pail, and rests on the pail's edge or on the wire so as to bring its top level with the edge. (See Plate VI., Fig. 1.) A little grain is scattered along this board. This trap will be most successful if there is no other water near by that the rat can reach. If he can get both food and drink here he will sooner or later try to take the bait, when, if the trap is carefully set, it will catch him by the neck and he will jump in and land on his head in the bottom of the pail, where he is either killed by the trap or held down by it and drowned at once. The other rats will not understand his disappearance, and the trick may be repeated. This set must be carefully made and the trap kept covered with water. In winter it can be used only in heated buildings, where water never freezes.



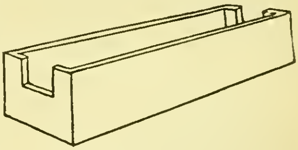
Wire shelf for water trapping.

This arrangement is sure death if the right trap is used and the set is properly made. A washtub may be used and four traps set, which will be likely to increase the catch, but all the shelves and traps must be carefully adjusted and the tub leveled exactly, so that all the traps may be entirely covered with water. All traps set under water for rats should be sprung and reset about twice a week and always set lightly. These precautions neglected, a small rat might not be heavy enough to spring the trap. The trap shown near the bottom of the pail (Plate VI., Fig. 1) is commonly sold as a rat trap. It is a very handy trap for this purpose but has two bad faults, — the pan is too large and the spring under the pan throws it up when the trap springs. If the rat happens to put foot or nose down on the edge of the pan it comes so little within the sweep of the jaws that it may be thrown out by the upward lift of the spring under the pan, or pulled out by the rat as the trap closes. In that case the cautious rat may not come again. The No. 1 "Newhouse" trap, having a small pan and a side spring, is best. The above plan cannot be used out of doors where the trap can be seen and where domesticated animals or birds can get at it, but rats may be trapped out doors in summer or at any time when water will not freeze, without danger of catching dogs, cats or poultry, if the trap is set in a covered trough.



Newhouse trap.

A watertight trough or open box must be made of boards or cement. It may be 12 inches long, 4½ inches wide and 3 inches deep, inside measurement, or larger if the trap to be set in it requires it. In the upper part of each end an opening for the entrance of the rat is made in the center, 2½ inches wide and 1¼ inches deep. (See cut.) This allows the rat to come in only where the pan of the trap is ready to receive him. The trough must be set level into the earth up to the bottom of the opening, and filled with all the discolored water it will hold. The water is discolored so that the rats cannot readily see the trap. The trap should be set in the trough under water, and next to one of the entrances, and if the trough is long enough two traps may be set, one at each end. The trough may then be covered with a board or box projecting well out over the entrance holes, or two small drain



Trough for steel traps.

tiles may be used as leaders, or a drain may be left open and the trough placed at its mouth leading into it. The whole thing should be so covered as to weight it well, render it dark, and keep animals larger than rats from getting at the traps. Thus advantage is taken of the natural tendency of rats to enter dark drains and dogs and cats are protected.

Traps may be set without bait, as bait sometimes arouses the suspicions of the rat. Twelve traps set in this way caught eleven rats in one night, and a gardener on an English estate catches from 100 to 150 rats in these troughs during the mild English winter.[1] A similar trough possibly might be made of split tile of 5 or 6 inches interior diameter.

A rat hole may be made in or under a rat-proof henhouse or shed leading into a long rat-proof trough or covered way, with a wire-covered opening at its farther end. The cover to this may be raised, and if a trough it may be filled with water and a number of steel traps set in it; if merely a covered way, flat traps. The rat having gone in, must come out again, running the gauntlet of the traps both ways.

When a trap is not set in water it should be a large one and the bait fastened to the pan; then when the trap springs it will take the rat "amidships" or by the neck, and shut off his breath at once, instead of catching him by the leg and allowing him to suffer torture.

In summer, outdoors, or in a shed or cellar at any time, an old rat may be taken by placing a little cotton under the pan of a steel trap, covering the trap entirely with loose dry earth and using some strong-smelling bait, like fish, which may be covered by a little chaff. Rats like to dig up things. In uncovering the bait your rat may be nipped. This plan works effectively and continually. New steel traps should be covered with earth for a day or two or well smoked, to take away the smell of the iron, before using them. Where rats refuse to take a bait tied to the pan the following plan may succeed: a dry goods box may be sawed off to two inches in depth and filled with bran or sawdust or some coarse meal. This may be set in a place frequented by rats and unbaited traps set in it close to the sides, with the chains fastened radiating outside, so as to keep a caught rat from getting into more than one trap. Cover all with bran in which scatter small bits of any alluring bait. To render the box still more attractive, an upright stick about a foot long may be fastened in the center with a choice tidbit, large enough to be conspicuous, tied to the top. Some strong-smelling fish or ancient meat will do. Some rat is likely to be caught while dancing around the pole. The box should be moved rather frequently and a different kind of bait tried every few days. If the rats learn to climb the stick and get the bait, avoiding the trap, the bait may be hung by a string. In prancing around after the swinging bait the rats may get incautious. When they have learned to avoid the box a quantity of bran, fine sand or fine sawdust may be spread near the rat holes, and when the customary trails of the rats are shown by the tracks, unbaited traps may be set carefully where they run, and covered by the bran or other material; or an old chair may be set against the wall, the trap set beneath it, bait tied to the pan and the seat of the chair covered with straw hanging down to the floor on all sides; or a trap may be set near a rat hole and covered with a light weight, dark-colored cloth; or set in a bucket in meal or bran, with a piece of toasted cheese tied to the pan, and the bucket covered carelessly with a weighted cover or board having a rat hole made just over the trap. If the rat jumps in he may spring the trap, or he may try the cheese and be caught by the neck, or he may tread on the pan in jumping out, with results disastrous to his peace of mind. If he does not go in, remove the cover and try him that way, covering the trap with meal.

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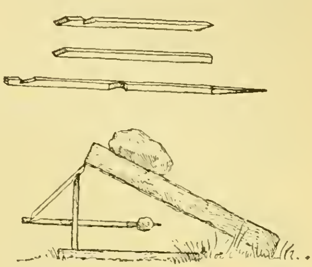
[1] The Field (London), Vol. 121, March 15, 1913, p. 493.

In covering steel traps with cloth, sawdust, meal, etc., care should be observed not to get much of the material over the jaws near where they are hinged, as that will interfere with the proper closing of the trap. Some trappers use a "bed" of feathers and other light materials in which food is scattered, until the rats come nightly, then carefully cleaned, smoked traps are buried in the bed. For this purpose good snap or "break-back" traps may be used in place of the steel trap, but the steel trap is best.

Sometimes a weighted deadfall will kill a cautious rat. A bit of plank, well weighted, supported with a "figure 4" trigger, built to "throw clear," covered with straw and enticingly baited, may do the business. (See cut.)



"Figure 4" trap and details of construction.

Rats drink a great deal, and in houses where there are no wells they resort to any accessible water tanks in garrets or closets. Traps set in dark places near such tanks are likely to bring results.

When visiting a trap it is best not to go too near it or touch it for several days, unless it has been sprung. If a rat has been caught the trap should be cleaned and reset. If the trap has been sprung and has failed to catch him, reset it carefully and rebait it as before. In time the same rat may be caught.

When rats become so wary that they will not spring concealed traps, watch for them and mark their runways, and set unbaited and uncovered traps there. If such a trap is set on a narrow joist, or where rats are known to run, they will see it, become accustomed to it and may in time become careless and spring it by jumping or running over it. I have taken one old rat in this way on the third night after setting the trap. This rat had not touched carefully set and baited traps.

Rat Bait. — Rat catchers and other experts differ regarding the best bait for rats. Some believe that rats should be baited with the food to which they have been accustomed, — fish should be used in a fish market, meat in a meat market, and grain in a stable or grain store; others contend that the opposite plan secures best results. In the experiments made by the Massachusetts State Board of Agriculture a combination of both plans was successful. Where rats could get only grain, oatmeal or rolled oats was used in small quantities about the traps; a little was sprinkled on the tread and a light trail of oatmeal was laid from trap to trap, while the traps were baited with bacon, cheese, sausage, or some other animal food. Sometimes when rats are feeding on grain some strong smelling animal food, such as toasted cheese, bacon, sausage, fish or fish heads, will attract them where grain will not. The bait commonly used for the flat traps (Plate VI.) was a small bit of fried bacon. When forty or fifty traps were to be baited quickly, a piece of bacon was fried, cut into pieces with scissors, each piece pressed into the hole in the tread of a trap, and the partly melted grease poured in until the hole was filled. Also, strong smelling cheese was used; it was toasted, and, while still hot, forced into the hole in the tread with a knife blade. These traps require very little bait. Other traps, where the bait must be tied on or hooked on, may be baited with cheese, bacon, corn, or any tenacious meat or vegetable bait. Some writers assert that a rat has no choice of food, but I have known rats to pay no attention to stale, dirty bait for weeks, and to be caught immediately when the bait was changed for something more enticing. It is a good plan to change the bait now and then, using some tempting food other than the one commonly employed. Cakes, doughnuts, honey, syrup or molasses, chicken, chickens' feet, scraps of raw or cooked beef or pork, prunes and other fruits and fresh vegetables all may be useful.

The Wire Cage Trap. — Where rats are numerous, particularly about slaughterhouses or meat markets, the large nineteen or twenty inch French wire cage traps may be useful. The smaller cage traps, made of light wire, often will not hold strong, full-grown rats, which will force the wires apart, but the larger traps, if made of stiff, strong wire, well bound with lighter wire, will hold a rat of any size. More than 25 rats, mostly young ones, have been taken in one of these large traps in a single night, and 200 have been taken in a season, but this is very unusual. Many of the smaller wire traps are in use, and though ordinarily set without any precautions, some success in their use has been reported by many Massachusetts people, but wire traps are not commonly nearly as effective as snap traps properly handled, and young rats are largely the victims. In many cases, where wire traps are exposed openly to view, rats cannot be enticed into them, and if once rats are caught in one their fellows may avoid it afterward. In such a case, where a trap had been set fruitlessly in a barn for weeks, baited with grain, I pushed it aside against a horse stall, changed the bait to fried bacon and fish, covered it with two meal sacks and a heap of hay, leaving a small opening at the front, and the next morning six rats were inside. If this stratagem be tried in cold weather it is better first to cover the trap with short boards, to prevent the rats from drawing in bagging and hay for a warm nest, and so interfering with the working of the trap. Rats like to burrow in dark and obscure places under hay or rubbish to find food, and advantage should be taken of this tendency; but the plan may not succeed the second time. Some trappers have been successful by keeping one rat, a female, constantly in the trap, feeding her well and using her to entice others. Failing in this, the location of the trap may be changed, and it may be baited daily, covered, and left open at both ends, so that the rats can run through it freely. When they begin to run in and take the bait nightly, they may be fed thus for several days, and then the trap may be baited well and the door at the back closed. Professor David E. Lantz of the Biological Survey tells me that a merchant of his acquaintance succeeded in catching many rats by enclosing the trap in a box, with a hole opposite the entrance. He then left the trap open at the back, so that the rats could go in the front way and feed, pass out at the back door, and jump out at the top of the box. When all the rats had become accustomed to feeding there, he fastened down the cover of the box, and the next morning the rabble was within. The editor of "The Field" states that not a rat would touch his wire trap when it lay in the open, but when it was taken up, baited with refuse fish, and covered with an old mat, some "lovely specimens" were found entrapped the next morning.[1]

A correspondent asserts that he placed one of these traps in a meal sack, leaving the mouth of the sack open and using anise, and that the next morning he had a "trap full" of rats.

Cornstalks, straw, old rags and any rubbish may be used to cover the trap, but if set on the ground it should be placed upon a board, to prevent rats burrowing underneath and securing the bait through the wires. All the precautions heretofore recommended for handling other traps, such as smoking the trap and handling with clean or scented gloves, are applicable here. The following directions by Dr. W. Colby Rucker of the United States Public Health Service are excellent: —

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[1] The Field (London), Vol. 89, May 1, 1897, p. 692.

> Before setting, the lever on the trap should be tested to see that it works properly. The trap should be placed on a hard surface, with the rear end a little higher than the entrance, so that the trap will close promptly. When setting the trap in the open it should be fastened to a board on which about an inch of soft dirt has been spread. Place the trap where the rat usually goes for food, or in a runway, and disturb the surroundings as little as possible. It is sometimes well to place the trap near where there is dripping water, as the rats come there to drink. If the trap is set in hay or straw or wood it should be covered (with the exception of the entrance) with this material. . . . The bait should be fastened to the inner side of the top of the trap with a piece of fine wire, so that the first rat in cannot force the bait underneath the pan and thus prevent the entrance of other rats. A few grains of barley should be scattered near the entrance of the trap and a small piece of cheese or meat fastened to the pan with a piece of wire. It is often well to touch the pan with a feather which has been dipped in oil of anise or oil of rhodium. Before leaving the trap it should be smoked with a piece of burning newspaper to kill the smell of the human hands or the rats which have been in it. Do not handle the trap after burning it out. When trapping in a neighborhood where rats are known to exist the traps should not be moved for three or four days unless they have rats in them, as it is well for the rats to become accustomed to seeing them and thus become careless about entering. It is not wise to kill rats where they are caught, as the squealing may frighten the other rats away.[1]

The three styles of trap given above ought to be sufficient to clear any premises of rats. There are homemade traps, however, which have been often and highly recommended.

Barrel Traps. — Professor David E. Lantz speaks of a writer in the "Cornhill Magazine," "about sixty years ago," who gave details of a barrel trap by duplicating which over 3,000 rats were caught in a warehouse in a single night. The rats were enticed for several nights to the tops of barrels covered with coarse brown paper, upon which bait was placed. Then a cross cut was made in the paper, so that afterwards the rats fell into the barrels. (See cut.)

Another plan is to make a barrel head of thin light wood or cardboard, fixed to turn on a pivot. This tip-up is fastened up and baited until the rats feed nightly upon it, and then is released. (See cut.) "Pickett" says that an acquaintance of his tried this and found it a "horrible" success. In three days while he was away from home it engulfed 7 rats, 3 spring chickens, 1 high-bred hen and 4 prime young turkeys. Evidently, like most traps, it failed to discriminate.[1] Still another plan is to fix a narrow tip-up on the edge of an open barrel, one edge of which rests on a shelf while the other projects out over the barrel, with the bait fastened to the end of the tip-up.

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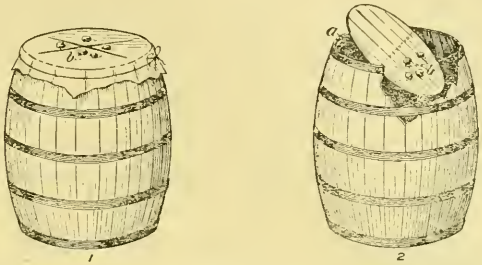
[1] Treas. Dept., Public Health and Marine Hospital Serv. of U. S., The Rat and its Relation to the Public Health, by various authors, Washington, 1910, pp. 154, 155.



Barrel traps: 1, with stiff paper cover; 2, with hinged barrel cover; *a*, stop; *b*, baits. (After Biological Survey.)

Much has been written about these traps. Stories are told of the great numbers of rats caught in them. It is said that a brick should be stood on end in the bottom of the barrel in water enough to expose its upper end. The first rat to go in is said to climb on the brick. The next fights the occupant for possession of the island, and the "row" is said to attract all the other rats, who immediately, fired with curiosity or the zeal of the explorer, plunge in and join battle, until only one rat is left alive. All this sounds interesting and encouraging, but in the experiments of the Massachusetts State Board of Agriculture such traps were arranged in several infested stores and buildings, and no one of them ever caught more than a rat or two. I have seen a barrel trap, specially constructed and guaranteed to exterminate the rodents, into which no one was ever able to entice a rat. Success with these traps may be possible if they can be constantly attended by a skillful trapper, and if the rats can be denied food elsewhere, but the traps must be kept constantly baited for days if not for weeks, until the rats have become accustomed to feed on them, trails must be made to entice the rats to them, and it is often necessary to provide a bridge or other means of reaching the barrel top, along which grain, crumbs or other bait must be kept sprinkled. All this requires room, and the arrangements must be left undisturbed. Where paper is utilized, it must be of a stiff, springy quality, so that when cut it will spring back into place when the rat has fallen through. Bait must be fastened to it, so that it will not fall in after the rat, and every barrel must be carefully tended and watched for a long time. The tip-ups must be nicely adjusted, so that they will not bind and will return quickly to place when tipped. Much time and trouble are required to make and adjust them carefully. In the ordinary store or farm building, the arrangement of the barrels is likely to be constantly changed by employees in the exigencies of business; the paper, if used, torn, and the whole plan upset. In a word, the scheme is not practicable except perhaps where all the conditions can be controlled by a skilled man.[1]

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[1] The Rural Library, Vol. 1, No. 2, How to rid Buildings and Farm of Rats and Other Pests of Like Character, May 19, 1891, pp. 8, 9.

The following proceeding is simpler and has given better results in the experiments undertaken by the State Board of Agriculture: —

A barrel, a large tub or a great kettle or cooker may have a false bottom made for it, which may be covered with chaff, among which grain, meat scraps, cheese, crumbs, etc., may be scattered, or the receptacle may be partly filled with any loose material, the top of which may be leveled, covered with chaff and baited. The rats must be trailed and enticed to this, and then fed there nightly until all in the building have found it. It is better to have a little water in the bottom from the first. When the rodents have become confident and hold nightly revels among the chaff, take out the false bottom or filling some evening, put in about 14 inches of water, scattering enough chaff on the top to cover it, with a few enticing bits of bait. This trap, properly handled, brings results, but no such trap can be used in winter in buildings where water will freeze, except by the use of extremely salt brine, and winter is the season when rats are most troublesome in buildings. Sometimes rats may be enticed into a deep barrel or can, such as a garbage can, and if the receptacle is about 30 inches deep they cannot get out. I have known three or four to be taken in a night by using a heavy cardboard box about 30 inches deep and sprinkling bits of meat, cheese and crumbs in the bottom. A deep garbage can sunk in the earth on a rat trail, with grain in the bottom, claimed some victims.

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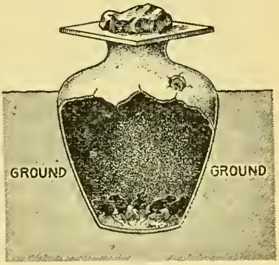
[1] Deep boxes are sunk in the ground on game preserves just outside the wire pens, and two tip-ups are arranged for the top of each box, so that any small animal coming from either side running along just outside the wire will fall into the box. Such traps, properly set and attended by skilled gamekeepers, are very successful. Poultrymen might use them.

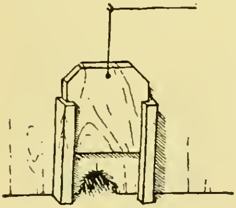
The jar trap (see cut) is said to be very successful.



A Burmese trap. (After Biological Survey.)

Rat Electrocution. — Metals charged with electricity are said to have some attraction for rats, and accounts of rat electrocution have been published. Dr. Rucker says that rats have been eradicated in cold-storage warehouses by suspending a bait between two heavily charged overhead wires at a point where the insulation had been removed. The hungry animal creeping along the wires shunts the current through its body, and, falling unconscious into a tub of water, is drowned.[1]

Rat Fence and Battue. — A movable fence or a wire netting of about one-half inch mesh, or even strong cloth or canvas and stakes, may be used to enclose piles of wood, rubbish, shocks or stacks of grain, and the material may be shaken free of rats and thrown over the fence, when the exposed rats may be easily killed by dogs or by men armed with clubs or wide flat shovels. Many thousands of rats have been killed in this manner. Rats may climb the fence, but if closely followed they will not have time to get out of the enclosure.



For grain room.

Grain-room Trapdoor. — A large grain bin or a grain room may have an opening made to admit rats, which opening may be closed by a little sliding door operated by a string from the outside of the building. In the evening, when the rats have gone in, the farmer lets go the string and the trapdoor closes of its own weight. Then he enters with a light and no rat escapes. A box may be set near the wall and as the rats run behind it it is pushed hard against the wall. This is one of the best traps known.

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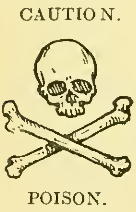
[1] Rucker, Wm. Colby, Public Health Reports, Vol. 27, No. 29, July 19, 1912, p. 1133.

Rat Poisons and Poisoning.

Poison skillfully and scientifically administered will destroy or drive away rats. Where rats are numerous, poisons are much more economical of time and money than traps, but rarely more effective, and the use of poisons is dangerous and generally cannot be recommended. I have used them only in the experiments conducted by the Massachusetts State Board of Agriculture, never having found poisoning necessary on my own premises. Nevertheless, notwithstanding the dangerous character of rat poisons, people will continue to use them, for scattering poisons involves less trouble and expense than setting traps. Therefore, directions for the use of poisons are given below, but with repeated warnings against carelessness.

There is always some element of danger to man and domestic animals, and often to wild birds and mammals, when poison is used. All poisons should be carefully and conspicuously labeled (see cut). They should be kept far from the medicine closet or the pantry, and should be locked up or hidden where children, servants and fools cannot get at them.



It is necessary here to point out in detail many ways in which accidental poisoning may occur. Cats or dogs may eat poisoned rats, with deplorable results. Where poisoned meat, bread, fats or cereals are used, they may be eaten by children and dogs, cats, poultry, etc. Where poisoned grain is exposed out of doors wild birds and poultry may be endangered. Poultry, dogs, cats, pigs and calves have been poisoned fatally, while children and adults have been poisoned either unintentionally or purposely when rat poison has been left incautiously about the house. Wherever poison is used about dwellings every care should be observed to cover securely water, milk or any beverage. As poison "drives rats to drink" after they have partaken of poison they drink whatever liquid comes in their way. If nauseated by the poison they are likely to vomit into the liquid, thus poisoning water, milk, beer and other beverages. If there is no other water they will climb or fall into open wells, which endangers the health if not the life of people who partake of water from such wells. If there is nothing for them to drink in the building they will get out of doors if possible, and take dew, snow or water from drains, etc. Rats are very resistant to some poisons and not many are found dead after poison has been used. I have found a few dead in such cases near or in water, sometimes many rods from the place where they were poisoned. The dying also retire to holes in the ground. Rats sometimes carry poisoned food about, leaving it where birds, poultry, dogs or cats can get it.

Poisons are impartial.

The use of traps will show definite results, but in the use of poisons the exact effect cannot be determined. When poisons are used on confined rats the results can be seen; but rats confined with poisoned food must eat it or starve, as they can get nothing else and cannot go elsewhere to feed. When poisoned food is put out for free rats some may be found dead, others may die in their holes. It is impossible to gauge the amount of poison that any rat may take. One may take just enough and die, another may take too much, which acts like an emetic, and the experience may or may not drive the rat to other quarters. Another may leave in search of water and never come back, or, finding water at hand, it may die in a wall or under a floor of a building, with the usual disagreeable consequences. Others may not touch the poisoned food, while still others may take just enough to warn them, but not enough to be fatal.

Certain proprietary poisons are advertised to embalm rats or dry them up. Of others it is said that the rats "don't die in the house." It is almost needless to say that these claims have very little foundation in fact. There is no poison known which a rat can eat and retain enough of to embalm its carcass, and now and then a poisoned rat may die in the house in spite of all precautions, but if the directions hereinafter described are followed, this mishap is not likely to happen often.

There is nothing new known in rat poisons. Those most commonly used are arsenic, phosphorus and strychnine. Common arsenical poisons are white arsenic or arsenious acid, and two other forms of arsenic, Paris green and arsenate of lead (London purple is rarely utilized). Squill, *nux vomica*, cyanide of potassium, corrosive sublimate (bichloride of mercury), hellebore, henbane, hemlock seeds and some other poisons have been used with varying results. Squill (*Scylla maritima*) is toxic or poisonous for rats, and in the quantities prepared for them is not fatal to larger animals. As arsenic, strychnine or phosphorus form the basis of the greater part of all the successful rat poisons used in this country, and as they are perhaps as effective as any in use, the various means of utilizing them will be considered here. The reader may inquire, if these poisons are effective, why recommend more than one? Unfortunately, with poisons, as with traps, we depend on the co-operation of the rat, which we cannot always secure. If the rats have tasted elsewhere the combination that we offer them they may refuse to touch it, and it may be necessary to try some other formula; or they may have already taken small doses of arsenic, for example, and may be somewhat resistant to its effects. Hence a number of different poisons and different preparations of each are given.

The chief difficulty in the effective use of arsenic and strychnine is to disguise them so as to get them into the rat in sufficient but not excessive quantity. Strychnine has a bitter taste; arsenic is more or less gritty in the mouth; phosphorus is easily detected, yet rats seem to like it, and for this reason it is one of the most effective rat poisons, *if properly prepared and used. No one should use any of the recipes or formulæ given here without first reading all that is written in this bulletin about poisons and their uses.*

Arsenic. — Arsenic (arsenious acid) being chemically unchangeable retains its toxic properties indefinitely under all conditions, and may be easily disguised, therefore it should be as reliable and effective as any poison. Professor Lantz writes me, however, that the Public Health Service, since distributing poisons at San Francisco and New Orleans, has become convinced that arsenic is a very unreliable rat poison. Nevertheless, it has been used effectively for this purpose for more than a century. On Thompson's Island, in 1907, when the rats had become so numerous that they were destroying everything edible on the farm, they were reduced almost to harmless numbers at once by quantities of ground fish and arsenic and sandwiches composed of bread, butter and arsenic. Five hundred pounds of fish and 50 loaves of bread were used.

Arsenate of copper, in the form of Paris green, which is much used as a commercial rat poison, has no advantage over white arsenic, except that of color, which renders it conspicuous, but it has the disadvantage that it contains less poison to the pound, and most of the commercial Paris green is adulterated. Arsenate of lead is a slower poison, of less strength than white arsenic, and though now much used it is not recommended. London purple has the advantage of conspicuous color. Arsenate of soda has not been used as rat poison so far as I am aware White arsenic is a very dangerous poison in the hands of a careless person, as it somewhat resembles flour; it may be bought at a low price by the pound from wholesale druggists. A time-honored way of administering arsenic to rats is to place pieces of bread and butter sprinkled with sugar near their runs night after night, until they have learned where to look for them and their suspicions have been allayed, then to spread *finely powdered* arsenic thinly over both sides of slices of bread and spread soft butter over the arsenic, or, better, mix arsenic with the butter before spreading, and sprinkle with sugar as before. The poison becomes incorporated with the butter, and is eaten without suspicion by the cunning rodents. Sometimes, however, the sly rat will eat the bread and avoid the poisoned butter, and it is better to melt the butter, stir in an equal quantity of arsenic, and pour the mixture on both

Pain and apprehension.

sides of the bread, so that it will soak in. The bread may be then cut in pieces about an inch square and each piece well sprinkled with powdered sugar. One piece should be fatal to any rat that will eat it.

This or any other poison should be put down at night in places where no dog, cat or child can get to it, and the remnants picked up and buried deeply early the next morning. Poisoning rats in dwelling houses is not recommended, but if all water and other liquids are safely covered or otherwise disposed of, poisoned rats usually leave if possible and go elsewhere in search of drink, dying in fields, outbuildings, swamps, or on some neighbor's premises where water may be found. Liquids in open dishes, bottles or cans, and water tanks in closets, attics or elsewhere, should not be overlooked in covering. When poisoning rats in barns and outbuildings it is well to have a small pan containing a little fresh water for rats to drink from for several nights in advance, and then to stir a tablespoonful of arsenic into the water on the night when the poisoned food is put down. Thus the rats, in their attempt to get relief, imbibe more poison, making their election sure. When rats once have learned the effects of arsenic those that recover will not touch it again unless it can be served to them in a form that they cannot recognize. Also, some rats will refuse at the beginning to take it in one medium, but may in another; hence the different combinations in which it is served, a few of which are here given. I wish to call attention to the wide variation in the percentages of arsenic in these preparations.

Arsenic and lard: Dr. Rucker says that the use of poisons has proven "very efficacious" in the rat-destroying work of the department in San Francisco, where, he asserts, arsenic and phosphorus have given very good results. Arsenic, he says, should be incorporated in some fatty materials, "such as lard, sweetened with sugar, flavored with anise or musk and colored a light pink" to denote its dangerous character. The lard readily takes up arsenic, which, so disguised, is usually taken by rats. A correspondent writes that he picked up three dead rats "near the watering trough" the morning after such a bait had been used. The proportions were roughly given by him as about a tablespoonful of arsenic to half a pint of melted lard, well mixed when hot and then cooled. Such a mixture may be used to advantage in the coldest weather, as it hardens but does not freeze. This contains only about $8\frac{1}{2}$ per cent of arsenic. A heaping thimbleful should be sufficient for one rat.

Arsenic, lard and corn meal: Dr. Rucker has sent me from New Orleans the following formula: arsenic 20 per cent, lard 34 per cent, corn meal 46 per cent. (Note the per cent of arsenic.) Half a thimbleful of this mixture placed in a rat hole ought to kill any rat that eats it. Cheese, mutton fat, and other bases may be used to deceive rats. Arsenic should be *finely* powdered when used as a rat poison, and when sugar is used with it brown sugar, which is moist, probably is best, but powdered sugar, which resembles arsenic somewhat in appearance, may disguise it better than the ordinary granulated article.

Waterton, the English naturalist, whose house was overrun with rats in his absence, gives the following as an effective mixture: —

Arsenic and oatmeal: a washbasin full of best oatmeal, two pounds of coarse brown sugar and a good dessertspoonful of arsenic, well mixed. A tablespoonful should be pushed well into every rat hole.[1] Assuming that a washbasin holds three quarts, the quantity of arsenic as compared with the other ingredients would be about $\frac{1}{5}$ of 1 per cent.

As washbasins now made hold from two to six quarts, some more exact recipe is needed, and this is given by Professor Lantz, as follows: take a pound of oatmeal (not rolled oats), a pound of coarse brown sugar and a spoonful of arsenic; mix well together and put the composition into an earthern jar. Place a tablespoonful in each run frequented by rats.

This formula has been given a wide circulation. It has two great advantages: (1) it is a nearly dry mixture and cannot freeze, and therefore can be used in the dead of winter, when rats need food most and are easily poisoned; (2) it does not stick together, and therefore cannot be carried about by rats, like bread and butter or arsenic pills, and perhaps left where domestic animals can get it, but I have never known this formula to clean out the rats, probably because the percentage of arsenic is much too small. Possibly the dose — a tablespoonful — might kill a rat now and then were he to eat it all, but there is no certainty that it will be eaten by one rat. Probably it is a safe practice in rat poisoning to mix so large a percentage of poison with the food that if a rat eats only a little he will die and as a means of safeguarding the rat against eating too much and then vomiting it, a small amount may be placed in each rat hole. When about 10 per cent of finely powdered arsenic was used in the mixture the rats disappeared, and some dead rats were found, but in most cases only a part of the tablespoonful was eaten. Less than half a teaspoonful would probably be an ample dose of the 10 per cent mixture.

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[1] Waterton, Charles, Essays on Natural History, 1871, p. 240.

When rats live in holes in the ground in winter they may be poisoned by this mixture in very cold weather by moistening dry earth or clay with water, thus making a quantity of mud or wet clay, placing a teaspoonful of the mixture in each rat hole and closing every hole with mud. This will soon freeze hard, and the imprisoned rats must sooner or later eat the poisoned food or starve.

The following rat catchers' recipes are abridged from Rodwell: —

Arsenic and flour or malt: a quart of good flour or malt; mix with it an ounce and a half or two ounces of finely ground arsenic; add ten drops of oil of caraway, two drops of oil of anise, and one drop of oil of lavender. These should first be rubbed well up in a handful of flour or malt, then stirred in well with the whole (here we have about 3 per cent of arsenic, which I should increase to at least 8 per cent). Malt may be procured of wholesale druggists or brewers.

Arsenical paste: take one ounce of finely powdered arsenic, one ounce of fresh butter, and make them into a paste with oatmeal and honey; rats eat of it greedily, then seek drink. (At least three ounces of oatmeal should be added, with honey enough to moisten.) This ought to give about 15 per cent of arsenic. As this is a most deadly thing, one should be very cautious in its use, and always wash the hands afterward.

Arsenic pills: take two ounces of fine flour, two ounces of lump sugar, beat to a powder; ten drops of honey, one ounce of arsenic, ground very fine, six drops of oil of rhodium, eight drops of oil of caraway; mix them all well together, and make them into a stiff paste with two or three spoonfuls of milk (over 6 per cent of arsenic in this); then cut into pills about the size of peas, and lay them where the vermin frequent.[1]

Johnson says that the following mixture is effective, and that rats never refuse it if first fed and left unmolested until they become bold and unsuspicious. A handful of good oatmeal mixed with a handful of newly ground malt and an ounce or an ounce and one-half of arsenic (about 19 per cent); make into dough and then into pills the size of a pea, and throw carelessly into rat holes. One of these pills carelessly twisted up in a piece of paper is said to rarely fail of its object.[2]

Arsenic, corn meal and eggs: mix twelve parts by weight of corn meal and one part of arsenic into a thick dough with white of eggs.

Arsenic and fish: this is a combination used by professional rat killers and is very effective where rats will eat it. Care should be taken not to handle the fish or arsenic unless the rats are accustomed to take readily food which has been handled. About half a gill of finely powdered arsenic may be thoroughly mixed with a quart of ground fish. A small fish split open, arsenic rubbed in the cut with a stick and the fish sewed up, may deceive some over-cautious rat. *Poisoned fish must be kept out of reach of dogs, cats and birds.*

Arsenic and milk: Mr. E. H. Reihl in Colman's "Rural World" gives the following plan to clear a barn of rats: each evening after the cows are milked a little fresh milk is placed in a shallow pan where the rats can get it easily. This is continued for a week or more, until the rats get bold, then arsenic is mixed with the milk. Care should be used that no animals or children have access to the barn.[3]

Official arsenical rat poison: as this goes to press I have received from Passed Assistant Surgeon J. R. Hurley of the Public Health and Marine Hospital Service of the United States the following formula, which the department has been using in San Francisco and which, so Surgeon Hurley informs me, has been evolved in the San Francisco office as the result of experience and experimentation, and has been found there to be practically as efficient as phosphorus. Laboratory experiments show that any rat that eats any quantity of this poison dies within a few days. The quantity of each ingredient given is large and the ordinary householder or farmer might find one-tenth this amount amply sufficient for his needs.

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[1] Rodwell, James, The Rat, 1858, pp. 256–259.

[2] Johnson, T. B., The Gamekeepers' Directory, 1851, p. 45.

[3] Colman's Rural World, Vol. 61, 1908, p. 27.

White arsenic, finely powdered,	4 pounds.
Cheese,	4 pounds.
Glycerine,	6 ounces.
Water,	1½ gallons.
Corn meal,	10 pounds.
Black aniline, sufficient to color to a slate gray.	
Oil of anise,	½ ounce.

Melt the cheese with the glycerine and one-half gallon of the water, then add the corn meal and the balance of water, and continue to heat until the corn meal is thoroughly cooked. Then stir in the arsenic and black aniline, and lastly add the oil of anise. It may require more or less water for the above formula, according to the amount of starch in the corn meal, but the quantities as given above are for average quality of corn meal.

It is essential in the preparation of this poison that the arsenic be powdered as finely as possible, in order that there shall be no grit in the paste when completed. The black aniline is added until the color of the paste is a slate gray, the idea being to have the color of the poison approximately the same as that of the surrounding ground. In this manner it does not attract the attention of children, dogs, chickens or other animals.

In the preparation of the paste none of the ingredients should be handled by the bare hands, as there is reason to believe that the odor of the human being attaches to the poison, and in some instances may render the rat suspicious of the poison.

The paste when finished is placed in ordinary tin fruit cans, each can containing four pounds of paste. Each man places one can per day, and each can of four pounds should be sufficient to poison approximately from 800 to 1,000 holes or runs. The poison is placed with a small mixing spoon, somewhat similar to a cheese scoop, and a piece approximately the size of a hazelnut is placed in each hole or rat-run, in such manner as to be thoroughly concealed from the observation of any person or animal except the rat which uses the hole or run.

The glycerine keeps the paste moist and in a fresh condition practically indefinitely, and it was not unusual to learn of dead rats being found in a vicinity where poison had been placed three or four weeks prior to the discovery of the dead animals.

Probably this is one of the most deadly arsenical mixtures ever invented, but if rats do not take it one of the others least resembling it should be tried. Where they will take no arsenical mixture, as is sometimes the case, other poisons may be resorted to. It will be noticed that the percentage of arsenic in the above mixtures varies greatly. My own opinion is that where the quantity of arsenic is less than 8 or 10 per cent of the whole, the arsenic content should be increased to secure the best results.

Prepared arsenic: sometimes rats appear to be suspicious of arsenic in its ordinary form and will not touch it. John Mayer, an honest old gamekeeper, recommends prepared arsenic, to be used as follows: he takes a pound of fine malt, mixes in three drops of oil of rhodium, two ounces of sugar, eight cloves and a tablespoonful of caraway seeds, beating all fine in a mortar. This is put out in small quantities, until rats take it freely. Then the arsenic is dissolved by pouring muriatic acid upon it and mixed with the bait.[1] The effect of muriatic acid is to reduce the arsenic and make its action quicker. Hence, a large percentage of arsenic should be used, that the rat may be fatally poisoned before the symptoms alarm it. The acid, having dissolved the arsenic, evaporates, leaving the arsenic as a fine powder.

Strychnine (*Strychnia sulphate*). — Strychnine has given results in practical experiments and is a very effective poison, but should never be used in a dwelling except where the rats cannot get into the walls, as the action of strychnine is very rapid. As compared with arsenic it is expensive, but is so quick and deadly in its action that a very small quantity will do the work of a much larger dose of arsenic. Its great drawback is its bitter taste, which warns the experienced rat, but this warning often comes too late when a very small quantity of the poison has been inserted in meat or fish. If used on grain the taste must be disguised as much as possible with syrup or sugar.

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[1] Mayer, John, The Sportsmen's Directory, 1845, p. 148.

Strychnine syrup may be prepared as follows: add half an ounce of strychnia sulphate to a pint of boiling water; dissolve it, then add a pint of thick sugar syrup and stir well. Oatmeal or other cereals or bread crumbs may be thoroughly moistened with the syrup and distributed in small quantities in rat holes or runs. All that is not taken should be carefully cleaned up.

Strychnine and sweet corn: sometimes this is recommended, but is dangerous to birds and poultry and should be used with caution. It was used with some success at Thompson's Island by soaking corn in a bucket of hot water in which an ounce of strychnia sulphate had been dissolved. The corn was soaked twenty-four hours, and sugar was added to counteract the bitterness of the strychnine. It should be dried in the sun where no bird or animal can get it. Some of it was taken by rats and some rats were found dead. Dr. Rucker finds that rats will rarely take wheat poisoned with strychnine although squirrels will.

Strychnine and fish: insert in a cut in a small piece of fish as much powdered strychnine as will equal half a grain of wheat (about one-tenth of a grain of the poison by weight). This may be rolled inside the bait, and the pellet placed far down a rat hole.

Strychnine, butter and cheese: Mrs. E. O. Marshall of New Salem, Massachusetts, reports continuous success with cheese treated as follows: two grains of powdered strychnia are spread with butter on a bit of cheese about one-quarter inch thick and an inch square. This amount of strychnine should be sufficient to kill at least ten rats, and probably would kill twenty if divided into equal doses and administered separately to each rat. Half a dozen pieces of cheese thus treated are used in the granary now and then; these pieces disappear quickly, and have so reduced the numbers of rats that where they were formerly to be seen running in every direction now they are not seen at all. Mrs. Marshall asserts that rats take cheese in preference to grain. Probably the aroma of strong, fragrant cheese disguises the taste of the strychnia until the deed is done.

Phosphorus. — This is perhaps the most widely used poison for rats and mice, and is every effective if properly prepared and used. In an experiment with phosphorus conducted by the Massachusetts State Board of Agriculture the rats disappeared. Many recipes for making phosphorus compounds have been published, but I cannot recommend any of them for general use, as many fires have resulted from the use of homemade preparations.

Professor Lantz says that the phosphorus paste of the drug stores is composed commonly of dissolved yellow phosphorus mixed with glucose or other substances, and that the proportion of phosphorus varies from $\frac{1}{4}$ per cent, which is too small to be always effective, to 4 per cent, which is dangerously inflammable. He has proved by experiment that a commercial phosphorus paste when exposed to sun and rain became so changed that it set fire to paper.

The paste is for sale either as such or under some other name as a rat poison at many drug stores and some grocery stores, and those who wish to experiment with it can obtain it without difficulty. Its odor, unless disguised, usually is something like that of matches, and it shines in the dark, which, no doubt, attracts the rats to it at night. It may be spread like butter on bread or cake, and when swallowed by the rats creates an intense inward burning and thirst, so that if no water is available upon the premises they will leave at once, if possible, in search of it.

Mr. F. L. Hitchings of the State Fish Hatchery at Sandwich, Massachusetts, makes an effective phosphorus poison by placing six bunches of Portland Star matches in about a pint of water that the heads may soak over night. In the morning he stirs into the resulting solution granulated Indian meal, enough to take up the water.

Barium Carbonate. — The Biological Survey, United States Department of Agriculture, recommends barium carbonate as one of the cheapest and most effective poisons known for rats and mice. Prof. David E. Lantz says that it has the advantage of lacking taste or odor; that it has a corrosive action on the mucous membrane of the stomach if taken in sufficient quantity; that in the small doses fed to rats and mice it would be harmless to other animals, and that its action upon rats is slow, so that if possible they usually leave the premises in search of water. This would appear to be the best rat poison known,[1] but Dr. Rucker of the Public Health Service says: —

> This has not proven an effective poison owing to the fact that it is easily decomposed by the vegetable acids, especially lactic and oleic acid found in cheese and oil. The poisonous effect is not greatly altered by this change. A disagreeable metallic taste is produced and the rats will not take it.[2]

In the experiments conducted by the Massachusetts State Board of Agriculture, rats rarely took this poison, and when it was given to others to try, they reported that rats gave it "the absent treatment." Although they were first fed food preparations without the barium carbonate, they would not touch them after the barium had been incorporated.

Professor Lantz finds this poison effective when prepared as follows: —

> Barium carbonate may be fed in the form of dough composed of four parts of meal or flour and one part of the mineral. A more convenient bait is ordinary oatmeal with about one-eighth of its bulk of the mineral, mixed with water into a stiff dough. . . . The prepared bait should be placed in rat-runs, about a teaspoonful at a place. If a single application of the poison fails to kill or drive away all rats from the premises, it should be repeated, with a change of bait.

Rodwell recommends the following: take a quarter of an ounce of the powder. Make it up, with two ounces of flour or meal, into little balls, like marbles. The addition of two drops of oil of anise seems to make it more attractive to rats, but not to mice.[3]

One difficulty in regard to procuring barium carbonate is that most drug stores apparently do not carry it, and some druggists are likely to "palm off" barium sulphate upon the purchaser, but the *precipitated* barium carbonate (which is best) should be kept in stock by all leading wholesale druggists. It is an old and well-known rat poison, which apparently has been used with good results by many people.

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[1] Lantz, David E., U. S. Dept. Agr., Biol. Surv. Bull. 33, pp. 44, 45.

[2] Treas. Dept., Public Health and Marine Hospital Serv. of U. S., The Rat and its Relation to the Public Health, by various authors, 1910, p. 157.

[3] Rodwell, James, The Rat, 1858, pp. 261, 262.

Directions for Use of Poison in Poultry Houses. — No poison was used in poultry houses in the experiments made by the Massachusetts State Board of Agriculture, as the owners were not anxious to take the risk, several having already poisoned fowls. I cannot recommend anything but rat-proofing for poultry houses, but the Biological Survey recommends the following plan: —

> Two wooden boxes should be used, one considerably larger than the other, and each having two or more holes in the sides large enough to admit rats. The poisoned bait should be placed on the bottom and near the middle of the larger box, and the smaller box should then be inverted over it. Rats thus have free access to the bait, but fowls are excluded.[1]

If strychnine is used the poisoned rats may not be able to get out of the box, or if they leave it they may not get to their holes and may be picked up in the morning and buried to prevent other animals from being poisoned by eating them. There is always an element of danger, however, in using poison in a poultry house, as rats may carry out poisoned food and leave it where the fowls can get it. Mice when poisoned with strychnine are rarely able to leave such a box, and so may be poisoned in the house without much danger of disagreeable results.

General Directions for Poisoning. — Care should be taken in mixing and putting out poisons not to handle them or the food in which they are mixed unless scents are used on the hands, as in the directions for trapping given on page 209. Where rats seem suspicious of poisons it is best to put out unpoisoned material, such as that in which the poison is to be mixed, until the rats have become accustomed to eat it nightly. Then deprive them of it for one night and give them poisoned food the next. Poison should never be left out of doors where birds or domestic animals are likely to get it. If put in rat holes it should be inserted well in with a long-handled spoon. Poisoned meat should never be used in such cases, as it may be dug or pushed out by rats or dogs and eaten by dogs, cats or hogs. It is a good plan to dig a long trench in the ground, cover it with boards, boxes, etc., and feed and poison the rats in this trench. (See cut.)

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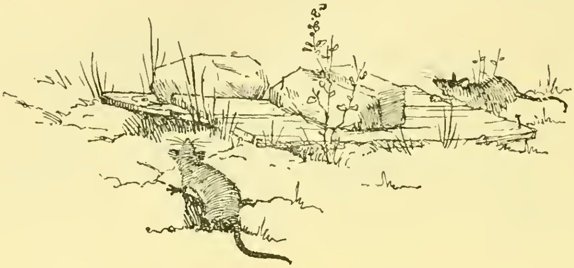
[1] Lantz, David E., U. S. Dept. Agr., Farmers' Bulletin 297, 1907, p. 5.



Reconnoitering the trench.

Antidotes for Rat Poisons. — If one accidentally takes rat poison, get rid of the poison at once by the use of a stomach pump, if a physician is at hand; if not, by the use of emetics. Vomiting may be excited also by tickling the throat with a feather or with the fingers, as well as by the free administration of warm salt or greasy water.

Phosphorus: give an emetic of mustard, a tablespoonful stirred to a cream with water, or, better, blue vitriol, three grains, dissolved in water, every five minutes until vomiting occurs. Give a teaspoonful of old, thick oil of turpentine; also, one-half ounce of Epsom salts in half a tumbler of water, and if there be much pain, twenty drops of laudanum in water. Give no other oil, because this promotes the absorption of the poison.

Arsenic: promote vomiting with copious draughts of warm water or mustard, one tablespoonful stirred to a cream with water. Get from a drug store hydrated peroxide of iron and administer a cupful of it. It may be made by mixing one-half ounce of perchloride of iron with half a tumbler of water and the same quantity of the solution of washing soda. Follow with olive oil or the white of eggs raw, also Epsom salts, one-half ounce to half a tumbler of water; also twenty drops of laudanum in water, if much pain.

Strychnine: give emetics, chloroform inhalations, and chloral

PLATE VIII.

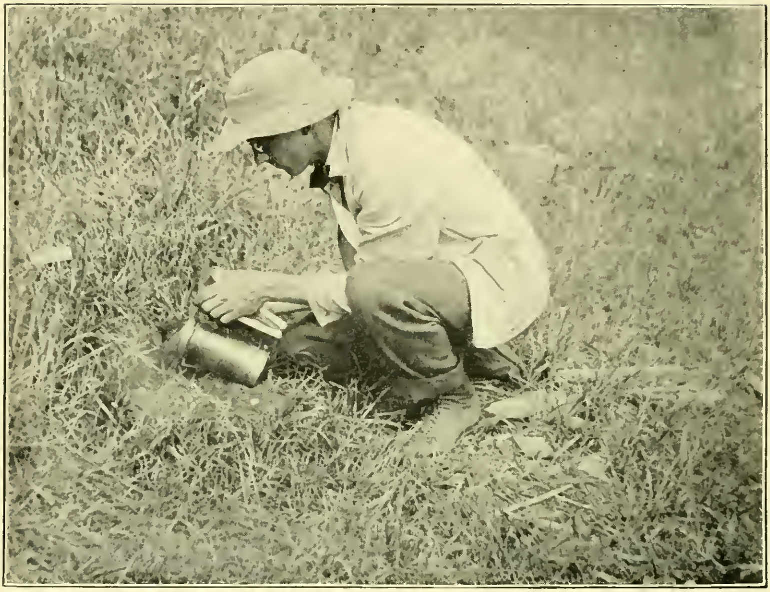


Fig. 1. — Smoker ready for use in finding connecting burrows. (Original photograph.)

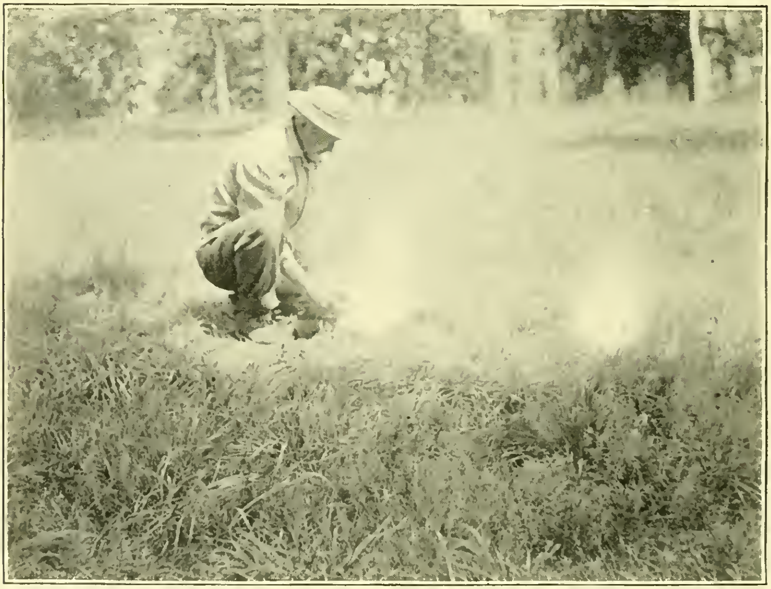


Fig. 2. — Smoker in operation, showing smoke emerging from connecting holes. (Original photograph.)

and bromide of potassium. Keep patient warm and quiet; administer strong tea. Give artificial respiration. (Reference Handbook of Medical Sciences.)

Barium carbonate: the antidote is any soluble sulphate, such as Epsom salts, Glauber's salt or alum. This should completely neutralize the poison. (Henry Leffmann.)

In any case of poisoning, a physician should be called as soon as possible.

Rat Deodorants.

Rats sometimes die within the walls of a dwelling whether poisoned or not, and the resulting odor is, to say the least, unsuited to the domicile of civilized man.

A compound of zinc and chlorine, commonly known as chloride of zinc, which has had a reputation for many years as a deodorant, antiseptic and germicide, may be useful at such a time. While the value of this compound may not be great for the two latter purposes it is effective in deodorizing. It is "capable of combining with hydrogen sulphide, ammonia and other offensive products of putrefaction, and forming compounds that are comparatively odorless."[1] It is more effective in neutralizing animal than vegetable odors. "Pickett" says that the following will purify the air in any room: "In one pint of boiling water dissolve half a dram of nitrate of lead; now dissolve two drams of common salt in a bucketful of cold water, then mix the two; dip a good-sized cloth in it and hang in the room."[2] No deodorants have been tested by the Massachusetts State Board of Agriculture, but in case of necessity either of the above may prove satisfactory.

Rat Fumigation.

Carbon Bisulphide in the Burrows. — For killing rats by wholesale in their holes in the ground, in ditch banks, dikes, river banks, levees, shores or dams, carbon bisulphide is the best agent known.[3] Unlike traps and poisons it does not require the co-operation of the rat. Carbon bisulphide is sold as liquid but quickly takes a gaseous form when liberated. It is not expensive when bought in quantity, requires no mixing or apparatus for application, can be used by anybody with ordinary caution, as its strong odor, like that of rotten eggs, immediately gives warning of danger, and is sure death to rats and to most other burrowing animals if properly used under right conditions. It should never be used in or about buildings where there is fire, as it is both inflammable and explosive. In the woods or fields it should be used after a heavy rain, or in winter or spring when the ground and grass are wet. Then there will be no danger of setting fire to grass or dead leaves, and the gas will be more deadly than when the soil is dry, as it will remain in the burrows instead of being dissipated through the minute crevices of the soil.

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[1] McClintic, T. B., Treas. Dept., Public Health Service of the U. S. Hygienic Laboratory, Bull. 22, May, 1905, p. 11.

[2] How to rid Buildings and Farms of Rats and Other Pests of Like Character, 1891, p. 9.

[3] Carbon bisulphide and carbon disulphide are identical.

The following method of applying the gas as used at Thompson's Island was very effective, as it killed practically all the rats in about 400 holes, where it was used experimentally. There the rats burrow in the banks around the high coast of the island, and many of them live in the burrows all the year, as they can find shellfish, garbage, etc., on the beach below throughout the winter, unless the harbor is frozen over, and they store up more or less food in their burrows. The first step in their destruction is to mark each hole by dropping a little plaster of paris at its mouth, and then to determine the number of burrows occupied. This was done by stuffing the mouth of every hole full of grass or seaweed. If a burrow is tenanted the rats are very likely to remove the grass at its mouth within twenty-four hours. In this work the ordinary bee smoker was used as a means of finding all hidden holes. When one hole is found, there are usually others connecting with it, some of which may be unused passages covered by grass, leaves or rubbish which, unless discovered and filled, will allow the gas and the rats to escape. The bee smoker is filled with cotton waste which is set on fire, and the smoke from its smouldering is puffed into a hole to the windward of others, if possible. Soon the smoke is seen issuing from all connecting holes, all of which are then closed with mud or wet earth, except one (the highest, if possible, as the gas readily descends). Then a bunch of cotton waste, grass or similar substance is saturated with one and one-half to two ounces of carbon bisulphide and pushed well into the open hole, which is closed immediately with the wet earth. In the government work on ground squirrels in California only one-half an ounce of carbon bisulphide was used to each burrow, but this was not sufficient on Thompson's Island, where the soil was loose and the rat colonies very large. It might be better in some cases to put one-half an ounce of the liquid into each hole, as the gas does not rise so readily as it falls, and it is conceivable that a much larger quantity of the gas might be needed in a case where the earth is loose and there are many large subterranean galleries. Caution should be used, as occasionally a spark may find its way from the smoker into a hole and ignite the gas, causing a small explosion, but if the grass and leaves are not dry there is no danger of fire, and the explosion serves to drive the gas into all passages and crevices. Some operators prefer to explode the gas in all cases, claiming that it is more effective. Two or three feet of hose and a funnel are used sometimes to carry the liquid deep into the holes. Where rats are very numerous, thousands may be destroyed in this way in a few days by one or two men. A trained fox terrier might be used to advantage in this work, as it would quickly locate early in the morning the burrows where rats had recently run in.

Dr. John D. Long of the Public Health Service has invented a machine for forcing carbon bisulphide into burrows which he claims economizes the gas.[1]

Other Fumigants. — In buildings hydrocyanic acid gas is destructive to all animal life, including insects, but is expensive, and so dangerous to human life that great care must be used in applying it. If used where rats can conceal themselves in the walls they may die there, with the usual disagreeable results. The method of preparing and using this gas is given by Dr. L. O. Howard in Circular 46, Bureau of Entomology, United States Department of Agriculture, 1907.

Carbon monoxide, chlorine and sulphur dioxide are used in fumigating ships to destroy rats and insects. Of these, sulphur dioxide is the safest, and is also used to extinguish fires. The two former are not recommended, the first because it is odorless, and may kill before the odor is detected; the other because it has a strong bleaching action on textile fabrics. Sulphur dioxide has a less marked bleaching action, and is recommended by the public health authorities for fumigating ships for the purpose of destroying rats to prevent the introduction of bubonic plague. Port regulations prescribe its use, and steamship companies provide vessels with special apparatus for generating the gas. For directions for fumigating vessels with sulphur see Public Health Reports, June 20, 1913, "The Fumigation of Vessels for the Destruction of Rats," by S. B. Grubbs and B. E. Holsendorf, and "The Rat in Relation to Shipping," by Wm. C. Hobdy, published in "The Rat and its Relation to the Public Health," by various authors, Public Health and Marine Hospital Service, Treasury Department of the United States, 1910, page 211.

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[1] Public Health Reports, Vol. 27, No. 39, Sept. 27, 1912, p. 1594.

Rat Viruses.

The Massachusetts State Board of Agriculture has not experimented with any bacterial infection, but has interviewed many people who have done so, and only three have reported satisfactory results. Careful experiments have been made with viruses by scientific investigators in this country, and the general verdict seems to be against their effectiveness.

Dr. M. J. Rosenau, Professor of Preventive Medicine, Harvard University Medical School, has made many experiments with various viruses advertised commercially. He has experimented with the bacillus obtained by Danysz and the commercial cultures known as ratite, azoa and ratin.

In the laboratory some of these viruses have been effective to a considerable degree under favorable conditions, but Dr. Rosenau does not recommend them for general use for the following reasons: (1) "Rats are notoriously resistant to bacterial infection." (2) The Danysz virus, which is pathogenic for rats under laboratory conditions, has feeble power of propagating itself from one rat to another; it quickly loses its virulence, especially when exposed to outdoor conditions; the other viruses have proven even less satisfactory in this respect. (3) The claim that these rat viruses are harmless to man needs revision, in view of cases of sickness and death resulting from their use reported by various observers.

PLATE IX.

A Useful Occupation for Boys.

Every boy has a rat. These rats were killed under the henhouse shown, by pupils of The Farm and Trades School on Thompson's Island, Boston harbor. Each boy was provided with a flat shovel, or a stick with a piece of old hose on the end. (Original photograph.)

Under natural conditions these rat viruses appear to act somewhat like a chemical poison. They have, however, these great disadvantages: they are comparatively expensive, and when taken in small amounts or after they have lost virulence they render rats immune.

The Biological Survey of the United States Department of Agriculture in co-operation with the Bureau of Animal Industry has experimented with ratin in both laboratory and field. The material (ratin No. 2, labeled "Trans-Atlantic Ratin") was furnished by the American agents in New York. This was claimed to be a bacterial preparation which would kill for six generations, but according to Dr. Rosenau, Professor Lantz says that it proved to be a glucoside poison (probably squill), and that it contained no bacteria.

Squill is an effective rat poison, and this proved to be such, although in some of the experiments a considerable percentage of the affected rats recovered, and subsequent attempts to kill them with this material failed. More than 100 rats were used in the experiment.

Dr. Rosenau says that the effect of this ratin is not communicable, as it is a poison and not a virus.

Ratin No. 1 (a real bacterial culture) was fed to rats and produced no apparent result. Several trials of azoa for the destruction of rats have been observed by the members of the Biological Survey. In some of these cases no results were noted. In one there was some measure of success. Experiments with the various rat viruses during the outbreak of the plague in San Francisco gave unsatisfactory results.[1]

Dr. C. H. Townsend recently has published in "Bird-Lore" a report of success with the so-called Pasteur virus, but in reply to an inquiry he writes now that the second trial was disappointing. Dr. Rosenau writes that he now sees no reason to modify his conclusions as given above. Scientists may yet find a virus that will be effective under ordinary conditions, but thus far the efforts in this direction seem to have met with disappointment.

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[1] The Rat and its Relation to the Public Health, by various authors, Treas. Dept., Public Health and Marine Hospital Serv. of U. S., 1910, pp. 186–188. See also Lantz, David E., U. S. Dept. Agr., Biol. Surv. Bull. 33, 1909, pp. 50, 51.

RAT SHOOTING.

Many rats have been killed with small bore rifles, but the surest and deadliest weapon is the shotgun. A thin straight line of grain or ground fish should be laid on the ground directly toward a door, window or loophole at which the gunner stands. When the rats have become accustomed to come out late in the afternoon or early in the evening to feed on the grain or fish, the shooter takes his stand, and, waiting until they have grouped themselves in line with their heads together on the bait, fires down the line. If they do not come to feed until after dark the gun may be lashed or clamped to the building in such a way as to "enfilade" the line. Then it will be only necessary to pull the trigger when by the light of a "bullseye" lantern or an electric torch it is seen that the rats are ranged properly. This method, with a cautious approach, has been successful, but no "set gun" should be left loaded. The charge of powder should be as heavy as the gun will carry, the shot No. 8 or 10, and the distance not over twenty yards.

RAT DROWNING AND CLUBBING.

At The Farm and Trade School on Thompson's Island, where the boy pupils are taught to kill rats, as all boys should be, there is a henhouse built with a cement foundation, but it has an earth floor and no foundation wall on the south side; therefore it is not rat-proof. The wooden floor of the main house is raised about three feet above the earth, leaving a space below it for a shelter for geese. Here the rats have burrowed in the earth, and as it was considered unsafe to use carbon bisulphide there on account of the fire danger, water was suggested. Two lines of common garden hose were attached to a near-by hydrant, the ends inserted into rat holes and the water turned on. All rat holes leading from the henpens to the outer world were closed with earth, and several boys were provided with sticks, to the end of each of which a piece of hose two feet long had been attached. A fox terrier was introduced into the henpens, and in about half an hour the rat war began. As the half-drowned rats came out of their holes somewhat dazed they were struck by side swings of the hose sticks, which knocked

PLATE X.

RESULTS OF RAT DROWNING AND CLUBBING.

Forty-six rats killed about a small henhouse on Thompson's Island in one afternoon. (Photograph by Mr. Chas. H. Bradley, Superintendent of The Farm and Trades School.)

them off their feet, to be killed by other blows. If one escaped into the henpens, boy or dog killed it. This operation was repeated later from time to time. Four successive battues several weeks apart yielded 152 rats from under and about this henhouse, and no doubt many young rats were drowned in their nests. Where no high-pressure water main is available burrows on the banks of pond, river or ocean might be cleared in this way by means of a powerful sewer pump and hose.

RAT ENEMIES.

Hawks, Owls, etc.

One cause of the increase of rats is the destruction of their natural enemies by man. In a country where game preserving becomes general, and hawks, owls, weasels and other so-called vermin are killed off, rats often become so numerous and destructive as to be more troublesome than all the other predatory creatures. Minks and weasels are far more effective as rat killers than the domestic cat, as these bloodthirsty animals are so thin and snakelike that they can follow the rodents to their nests, where the cat cannot go. Some of the larger hawks kill many rats in summer when rodents get out in the fields before dark, and the owls are the most useful of all ratters. The large owls take full-grown rats, but the smaller species can master only young rats and mice, of which each owl probably destroys many more annually than many cats. Dr. A. K. Fisher of the Biological Survey found about the nest of a pair of barn owls the skulls of 172 brown rats, 452 house mice and 128 field mice. The ground about a barn owl's nest in the Bahama Islands was covered with pellets containing rats' bones and fur. O. E. Niles states that he counted 113 dead rats at one time under the nest of a great horned owl.[1] Skunks are excellent ratters. A pair which burrowed underneath a large camp cook house soon cleared it of all rats and mice. If poultry is properly housed, skunks rarely do any damage, and they are very useful about a farm. A family of skunks remained in and about my henyards one season and destroyed numberless insects and never harmed a person or a chicken, although I have known disagreeable consequences to both persons and chickens to ensue under different circumstances. Many large snakes kill rats.

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[1] Treas. Dept., Public Health and Marine Hospital Serv. of U. S., The Rat and its Relation to the Public Health, by various authors, 1910, p. 165.

THE CAT.

Almost without exception rat catchers and writers on rats and their habits belittle the cat as a rat catcher. The consensus of opinion seems to be that while most cats catch mice, very few care to attack a full-grown brown rat. My own experience is somewhat at variance with this opinion. I believe that many stray or feral cats catch rats, and that some farm cats are fairly good ratters. The number of rat-catching cats in the city or town may be smaller. Many Massachusetts farmers rely chiefly on cats to keep their premises free from rats, but rarely, so far as I have been able to learn by actual observation, do they free their owners' buildings and grounds absolutely from the rodents; nevertheless, in some cases they keep down the increase.

The best ratter I ever observed was kept as an experiment, and caught about one rat a week on the average in and about my farm buildings for the nine months that she was kept under observation. She might have caught more had rats been more numerous there. Rats were seen often before the cat came; after her advent they rarely were seen or heard. They disappeared from the house for the time being and rarely came back, but a careful search for tracks and signs showed that they were as numerous as ever in and about the barn, and occasionally one entered the house but soon was caught. At the end of nine months eleven snap traps were set one night in the barn and the cat shut out. Some of these traps were old, rusty and nearly worthless, but the next morning four rats were found dead in the traps, two traps had been dragged away, and two more traps were sprung but ratless. Later, two more trapped rats were found dead. Thus, six rats were trapped at once in a building where the cat had been given every opportunity to catch rats for six months, and, had the traps been new, probably two or three more might have been taken. The cat never got more than three rats in one day,

PLATE XI.

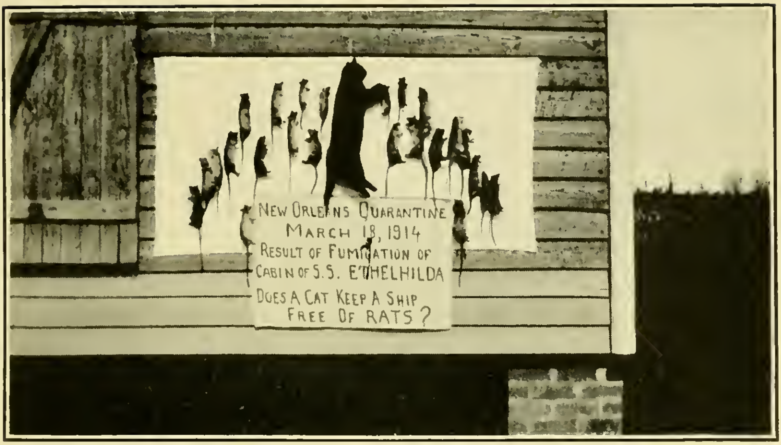
NEW ORLEANS QUARANTINE
MARCH 18, 1914
RESULT OF FUMIGATION OF
CABIN OF S.S. ETHELHILDA
DOES A CAT KEEP A SHIP
FREE OF RATS?

FIG. 1.—AN ILLUSTRATION OF THE INEFFICIENCY OF THE CAT AS A RAT CATCHER.

One cat and twenty-four rats as the result of fumigation of the cabin of a steamship. This cat was an exceptionally good ratter and was supposed to have kept the cabin free from rats. In fumigation she was overlooked by accident. (From Public Health Reports, Vol. 29, No. 16.)

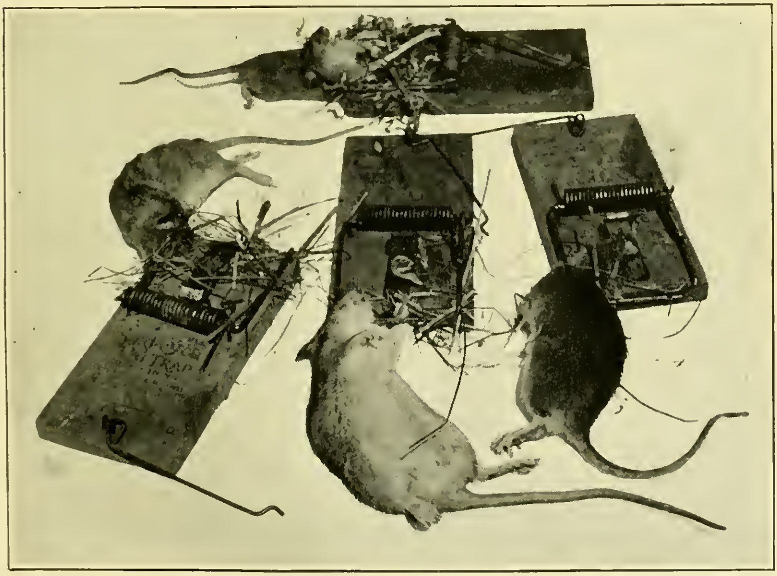

FIG. 2.—THE CAT FAILED.

Four out of six rats taken in 10-cent traps in the author's barn in one night, after rat-catching cat had been in same barn for nine months. (Original photograph.)

and these were enticed outside the barn for her convenience. Probably fifty rats could have been trapped in that barn in two weeks — after the nine months' work of the cat. Mr. Wilfrid Wheeler had a cat that at one time averaged two rats a day for a week, but the rats were so numerous there that the cat made no visible impression on their numbers, and finally poison was resorted to. The two cats above named may be considered excellent rat catchers.

The following letter from Surgeon G. M. Corput in the United States Public Health Reports shows how little dependence can be placed on the cat as a rat exterminator: —

> Every quarantine officer is familiar with the old plea of shipmasters that there is no use of fumigating the cabin of a vessel because there is a cat on board which is an excellent ratter and renders it impossible for rats to live in cabin. The enclosed pictures are the result of not believing this story. (See opposite page.) The British steamship "Ethelhilda" arrived at this station [New Orleans Quarantine] March 18, from the west coast of Africa. The captain assured me that it was impossible for any rats to be in the cabin of his vessel because of the presence of an exceptionally good cat. The cabin was nevertheless fumigated. Through the irony of fate the cat was forgotten. When the cabin was opened up the enclosed picture shows the result. (See opposite page.) Every part of the ship had many rats. The picture is limited, however, to what was found in the cabin, — one cat, twenty-four rats.[1]

A rat-catching cat no doubt tends to drive rats away from the dwelling where it is domiciled to some other place where such cats are not kept. Nevertheless, if rats have good harborage and a plentiful supply of food, they often remain and increase in spite of the best of cats. For this reason many farmers are not content with one cat but keep a number, which they find more effective than one in keeping down the rat population. It costs very little to keep cats if they are fed only the "strippings" at milking time, and are allowed to pick up their own living otherwise. In this way from three to forty cats are kept on some farms, some of which are worthless as rat catchers. In such cases there is doubtless a great indirect loss to the farmer in the number of insect-eating birds that the cats destroy, which if it could be reduced to dollars and cents would surprise him. Probably in most cases two selected efficient cats would do about all the rat killing that cats can be expected to do on the ordinary farm.

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[1] Public Health Reports, Vol. 29, No. 16, April 17, 1914, p. 928.

A wholesale grocer found his store most free from rats when he kept fourteen cats, but he had to dispose of the cats, as they did about as much damage as the rats and ate more.

The cat is unnecessary as a mouse catcher, for all mice may be trapped with the greatest ease. I never was able to get rid of the rats in my town house until the cats were disposed of, as traps could not be set freely without danger to the cats. After the cats had gone it was easy at once to trap any rats that invaded the place. Those who keep cats can help them to kill rats by baiting rats outside the buildings in the open, and making a place for the cat where it can watch from above and pounce down on them.

To sum up: by selecting cats carefully and keeping them in sufficient numbers rats may be held in check or driven away. Selected cats are serviceable to people who are too busy, ignorant, indolent or indigent to destroy rats. These classes include a large part of the population. Hence the prevalence of cats. The best ratters are small-sized female brindle or tabby cats, with small heads and large ears, but black cats sometimes are equally useful.

THE DOG.

The ordinary farm dog or pet dog is of little use as a rat catcher, but the Airedale and some of the smaller terriers are good ratters, and if not overfed and pampered they may be trained to a high degree of efficiency. The fox terrier cannot be excelled as a rat hunter. A single terrier has been known to kill more than a thousand rats in a year. I recently saw an ordinary untrained fox terrier catch and kill four large brown rats in an hour in open fields one moonlit evening. Had she been trained she might have killed two more that escaped. Probably no cat ever lived that could have covered the same ground and taken four rats in one hour. The cat sometimes spends days watching for a single rat and then misses him. One advantage of the dog is that it can be trained to assist man and to accept man's assistance, where the cat cannot. The dog is fearless and active, wastes no time torturing its prey, and can kill as many rats an hour as it can get hold of. Where rats are very numerous, man, dog and ferret working together can destroy great numbers in a short time.

THE FERRET.

Many people whose premises have been overrun by rats have obtained ferrets to drive them out. The ferret, like the weasel, can follow the rat into its holes and runways, and where rats are not too numerous and vicious they will fly from a ferret and leave the premises, but when the ferret has gone they come back; where rats are very numerous they may attack and even kill the ferret. But when two or three courageous ferrets and a bright fox terrier have been trained by their master to work together, the rats can be driven from their holes and caught by the dog, and thus a rapid deratization is effected. Even then, rats if very numerous may drive or kill a ferret, and ferrets are sometimes killed by accident or mistake in the hunt. Those who wish to keep ferrets will find directions for training them in a volume entitled "Studies in the Art of Ratcatching," by H. C. Barkeley, London, 1896.

I prefer the quieter, surer method of the trap to the use of any domestic animal.

RAT DRIVING AND HARRYING.

Many ways for driving rats out of buildings have been recommended. Some of these, like the old plan of writing a letter to the rat, may appeal to the superstitious, but are worthless so far as relief from the pest is concerned. Others are harmless commercial compositions manufactured and sold to deceive the credulous. Others actually seem to be of some service, but none will drive rats away permanently. It is far better to use some means to destroy the rat than to drive him to the premises of one's neighbor, whence he is likely to return in time with reinforcements.

Nevertheless, hunting, harrying and driving rats will tend to discourage them from settling permanently, and there are circumstances at times which make it desirable to evict rats temporarily from a certain spot.

In the experiments undertaken by the Massachusetts State Board of Agriculture, it became necessary to fumigate a large number of rat holes in a bank, but near by there was an old dike partially timbered which was so loose and open in texture that the scores of rat holes there would not confine any gas long enough to destroy the inmates, and when the rats in the bank had been killed off, it was soon populated again by the overflow of rats from the dike. Hence it became necessary to drive these rats to the burrows in the bank before it could be cleared.

Among the measures often recommended to drive rats away are: —

1. Sewing a red jacket on a rat (or painting him) and then liberating him.

2. Pouring kerosene over a rat and setting him afire, then liberating him after the fire has burned out. This horrible cruelty is supposed to frighten other rats away. Needless to say we have not tried it.

3. Placing a collar and bell on the neck of a live rat. Several observers have tried this and all report that it drives rats out of a dwelling or barn.

4. Dipping a rat in tar and releasing him. This has the same effect as the following.

5. Tar placed in all rat holes, runs and burrows. Rats dislike the smell of tar and its stickiness. This drives them, for the time being at least, from holes so treated. Also, they are not fond of turpentine. When in passing they rub either of these liquids upon the hair, their attempts to lick it off produce dissatisfaction with their defiled burrows.

6. Chloride of lime, loose or wrapped in old rags, placed in burrows. Several experimenters who have used this report success.

7. Crude carbolic acid, moist caustic potash or powdered red pepper placed in runs and burrows. (Carbolic acid will drive rats, but just now (October, 1914) it is very expensive.)

8. Feeding the rats oatmeal or flour mixed with plaster of paris.

The use of plaster seems to produce no effect if the amount used is small, while if a larger quantity is used the rats apparently do not eat it. But Professor Lantz tells me that in the experiments of the Biological Survey rats ate and digested freely plaster mixed with flour and meal in varying quantities, and that they also ate without inconvenience pieces of cork and sponge that had been fried in lard. Nevertheless, many people seem to believe that they have secured good results by the use of these methods.

Others report success with freshly slaked lime placed dry in all burrows and runs, freshly made hot thin whitewash poured in the burrows, and from a strong solution of copperas (ferrous sulphate) sprinkled in runs and burrow entrances.

Any or all of these proceedings tend to make life uncomfortable for the rat, and one or the other will reach and defile his domicile under nearly all circumstances. To drive out rats, one after the other of these agents might be used, beginning with chloride of lime or carbolic acid, but the surest way to get rid of rats is to starve them and pursue them with traps and poisons until the last one is dead, or, weary and affrighted, he takes his melancholy way to some more hospitable abode.

The plan that ordinarily succeeds best in driving rats from dwellings is to get most of them by carefully set traps, and if loneliness and apprehension of evil does not discourage the last one to the point of emigration, a little poison skillfully administered usually destroys it or causes it to make up its mind over night to depart.

CO-OPERATIVE RAT KILLING.

Co-operation in the destruction of rats like co-operation in most other matters is conspicuous by its absence in America, but co-operation is required to abate the rat evil. Under present conditions a farmer, householder or merchant may keep his premises clear of rats, but only through constant effort, because his neighbors make life pleasant for them and allow their increase to wander back to his premises. In England co-operation has made some headway. Rat clubs have been formed, giving prizes or bounties for rat destruction, and so ridding their own communities of great numbers of rats at little cost. Municipal employees have been required to hunt rats. Organized work in European cities has given excellent results.

In England a national society for the destruction of vermin has been incorporated, and a great international society for the destruction of rats has been organized in Denmark, which has had good influence there and in other countries, but so far as I know nothing of the kind has been attempted in America.

These societies have secured the destruction of enormous numbers of rats. In Denmark a government appropriation has been granted for the payment of bounties.

Side hunting, a relic of barbarism, which still persists in some parts of the United States, might be directed against rats rather than against useful song and game birds. A party of hunters choosing sides might hunt rats and thus benefit themselves and the community at large and at the same time enjoy the sport of hunting. Let rats be the only animals that count in the contest. This has been tried in some localities with excellent results (see page 179). May 2, 1909, was set aside in one of the counties of Kentucky as a day for killing rats, and was quite generally observed.[1]

A great national organization, with State branches, should have been formed long ago in this country to encourage the destruction of rats, to disseminate reliable information regarding rat riddance and to organize continuous systematic warfare against the pernicious rodents. Such an organization would have generous support if rightly launched, and might establish a deratization propaganda that would save millions of dollars and many valuable lives. Assistance might be secured from State and national governments, and the organization might become important and useful in our national life. The mayor of Boston now advocates requiring the rat-proofing of buildings. Dr. J. R. Hurty, State Health Commissioner of Indiana, proposes to the business men of Lafayette, Indiana, that all rat-producing conditions be abolished in that city, and that a city ordinance be passed declaring the rat a nuisance, and assessing, after a given period, a fine of $5 per rat against property owners on whose premises rats are found. The public is beginning to awaken to the rat danger.

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[1] Lantz, David E., U. S. Dept. Agr., Biol. Surv. Bull. 33, 1909, pp. 51–53.

SUMMARY.

The rat has become the greatest rodent pest ever known. It is more destructive to property and more dangerous to human life and health than any other animal. There is no panacea for the rat scourge, no one method that can be relied upon alone to exterminate rats. They should be starved and evicted by rat-proofing buildings, drains, food and garbage receptacles, and burning garbage or rubbish in or under which they feed or breed, and by quickly threshing and marketing all grains or storing them in rat-proof buildings. Then, suffering the pangs of hunger, their breeding places destroyed or exposed, they may be readily trapped, poisoned and shot, or harried by man and their natural enemies. Fumigation of burrows with carbon bisulphide is exterminative where conditions are favorable for its employment. The so-called animal viruses, Pasteur viruses, etc., are expensive, and apparently not efficient enough in practical service to warrant their general use. Co-operative efforts with all effective methods and continual persecution are required to abate the rat evil.

ESSAYS.

(Especially prepared for the Sixty-second Annual Report.)

CRANBERRY GROWING.

HENRY J. FRANKLIN, PH.D., SUPERINTENDENT CRANBERRY STATION OF THE MASSACHUSETTS AGRICULTURAL EXPERIMENT STATION, WAREHAM, MASSACHUSETTS.

The cultivation of the cranberry as a commercial enterprise was begun on Cape Cod about fifty years ago. While the cranberry plant is a native of northern Europe and Asia as well as of North America, it has never been put under cultivation in the Old World. The conditions on Cape Cod appear to be peculiarly adapted for the growing of this berry, and as the business from the start was found to be profitable it developed to such an extent that it is now considered the most important industry on the Cape. It now brings in a total net return annually of between $1,500,000 and $2,000,000 to those interested in the growing of this fruit in Massachusetts. It has also been found that other sections of North America are suitable for the commercial growing of the cranberry, and it is now grown successfully in New Jersey, Wisconsin, Nova Scotia, Michigan, and on the Pacific coast line of Oregon and Washington and on Long Island, these districts being named in the order of their relative importance as cranberry-growing regions. The Cape Cod region produces annually considerably over half of the cranberries which are grown commercially, New Jersey producing over three-fourths of all the berries grown in the other sections. No very definite and accurate census of the cranberry acreage appears to be available, but the government census indicates that over 20,000 acres are under cranberry cultivation in the United States. These figures, however, do not really show how much land is devoted to the industry, for they do not include the land that is used for a variety of purposes in connection with most bogs, such as sand banks and other necessary upland surrounding the bogs and the land used for reservoirs. If all this incidental land were included with the land actually under vines, the total acreage devoted to the production of this crop directly and indirectly would probably not be less than 40,000 acres.

The average annual yield of cranberries per acre on the Cape is a little less than 40 barrels. In all the other cranberry-growing sections, except those of Washington and Oregon, the average per acre yield is very much less than this. This appears to be due partly to the superior natural conditions surrounding the industry on the Cape, and partly to the methods of culture employed — particularly with reference to the use of sand as a surface mulch. All the bogs on Cape Cod are covered with sand before the vines are set out, and they are also resanded more or less frequently after they have come to bearing. Sand is also used in a similar way in Oregon and Washington, but in New Jersey and Wisconsin only a very few of the bogs are sanded at all. Moreover, the Cape Cod bogs are, as a rule, kept almost entirely free from weeds, while in other sections the bogs are always very weedy, this freedom from weeds on the Cape being partly due to the use of the sand and partly to better care.

The following list, giving the cranberry production on Cape Cod, in New Jersey and in Wisconsin for the past few years, will give some idea of the lead that Cape Cod has in this industry over all other sections. It is the belief of the writer that the natural conditions are so superior for the production of this crop on the Cape that this lead will always be maintained, the comparative lack of suitable and accessible sand being a factor which must certainly always be a detriment to the industry in other sections. Moreover, the climate of the Cape seems to be more suitable than that of other sections, the warmer temperatures of New Jersey being apparently responsible for greater troubles with fungous diseases, and the colder climates of Nova Scotia and Wisconsin causing the berries many times to be smaller on account of the shorter growing season, and also the losses from frosts to be in proportion much greater.

Production of Cranberries.

Year.	Massachusetts (Barrels).	New Jersey (Barrels).	Wisconsin (Barrels).	Grand Total (Barrels).
1901–02,	240,000	105,000	40,000	385,000
1902–03,	215,000	30,000	46,000	291,000
1903–04,	204,000	168,000	18,000	390,000
1904–05,	226,000	83,000	21,000	330,000
1905–06,	146,000	88,000	18,000	253,000
1906–07,	240,000	103,000	45,000	388,000
1907–08,	284,238	121,000	21,000	426,238
1908–09,	229,860	75,000	12,000	316,860
1909–10,	372,835	165,000	30,000	567,835
1910–11,	287,046	241,000	16,000	544,046
1911–12,	273,120	143,000	30,000	446,120
1912–13,	317,605	112,000	45,000	474,605
1913–14,	338,850	100,700	30,000	469,700

This does not include cranberries not shipped over railroads and used for evaporating purposes.

Cranberries are of course essentially a luxury, but they have come into such general use, especially in connection with the Thanksgiving and Christmas dinners, that they may be looked upon as a commodity approaching the importance of a necessity, and up to the present time the widening of the market for them has so kept pace with the increase in their production that satisfactory prices almost always prevail for fruit in good condition. For several years the fear that there may come a time when the supply of cranberries will so exceed the demand as to make them a drug on the market has been present in the minds of many interested in the industry. While it must be admitted that there is a possibility that such a condition may come to pass, it must be borne in mind that there has not yet developed any considerable export trade except that with Canada and that the methods of disposing of the crop were very crude and hit or miss until within the last three or four years. Moreover, satisfactory methods for the preserving of this fruit have not yet been developed, and our knowledge of the best means for producing the fruit cheaply is probably in its infancy. It is to be hoped and expected that the development of an export trade and of satisfactory processes for preserving, the perfection of selling arrangements, the production of heavier average annual crops to the acre, by the stoppage of losses from insects and disease, and possibly also by the growing of more prolific varieties, which would lower the per barrel cost of production, will make it possible to grow cranberries at a reasonable profit and at the same time provide for a normal increase in acreage for many years to come. Better and more economical methods of harvesting, packing and shipping the fruit will also undoubtedly be developed and assist greatly in lessening the cost of production. The average expense of picking the berries and resanding bogs is at present altogether too high, and it is not unreasonable to expect that both these costs will sometime be much reduced by the use of machinery. It is to be hoped, also, that in time the sales companies of New England, New Jersey and Wisconsin, which at present, together as the American Cranberry Exchange, control the sale of over 60 per cent. of the cranberry crop of the country, will so develop their arrangements as to have large central packing plants where the process of preparing the berries for market may be so simplified and perfected that the expense connected with it will be considerably reduced.

To discuss fully all the matters of interest in connection with the cranberry industry would require more time and space than is allowed the writer in the preparation of this paper. There will be given here, therefore, only a brief discussion of what appear to be the more important essentials for the growing of cranberries, their preparation for market, and their preparation for the table, together with an itemized estimate of the present cost of preparing a bog.

The Essentials of an Ideal Cranberry Bog.

Land.

It seems to be the general experience that cranberries in cultivation, as in the wild state, do best on low, moist, swamp land consisting of muck or peat. The depth of this peat or muck soil need not, however, be very great, a few inches of peat or a single layer of turf underlaid by sand or clay very frequently giving most satisfactory results. It does not appear, however, that any muck or peat or even any sod is absolutely essential, for often portions of bogs grown on sand alone, so called "hard bottom," especially if fertilized, produce very satisfactory crops. A clay or marl soil in damp situations is often found highly satisfactory. Other things being equal, the freer the land is from brush or timber the better, for it is more easily and cheaply put into shape for growing cranberries. Fresh meadow has been frequently converted into cranberry bog without turfing, the grass being simply covered over with a good coating of sand and the vines set out without further preparation, except that of leveling and ditching, and the bogs thus made have been, in most cases, satisfactory, and they were certainly built at comparatively small expense. Brush swamps are in general to be preferred to wooded swamp land because of the smaller expense of clearing. If heavily wooded land is used, it is desirable to remove the stumps of the trees if this can be done without too great expense. It is advisable to cut the trees at the roots so that the stumps may be tipped out in felling. The stumps may be burned or removed from the bog. It is the writer's opinion, however, that much labor has been wasted on removing stumps, for it is a matter of common observation that, after a bog has been producing berries for several years, the vines are more thrifty and produce more fruit over buried stumps than on the portions between the stumps. It seems probable, therefore, that it would be wiser to cut down the tops of such stumps as are very hard to remove and cover them over.

Location.

A cranberry bog should be located on or close to a good stream of water, capable of furnishing quick flowage at any time during the year. In case the stream is of itself not sufficient, it is best to increase its capacity for flooding by building a reservoir further up the stream than the bog location. This reservoir, however, should be located as far from the bog as is practicable, and should not be kept full during the growing season any more than is absolutely necessary. If the reservoir is near the bog and is kept full all the time, it will impair the drainage of the bog and make it weedy. It is desirable that the bog should be open to the sunshine and winds instead of being surrounded by high uplands and woods, for a bog in an open location is less liable, other things being equal, to injury from frost, and its berries are more likely to set heavily, ripen early, and keep well when exposed to the maximum amount of sunshine.

Sand.

Clean sand, preferably coarse, or gravel should be readily obtainable from banks surrounding the bog location. Fine sand is often used for covering the bog with a mulch before the vines are set as well as for resanding them in subsequent years, but such sand appears always to promote the growth of moss and does not seem to be so effective in helping to keep down weeds as does coarse sand. Fine gravel is thought by many to be superior to sand.

Drainage.

A bog should be capable of good drainage. Poor drainage always promotes weed growth, and it usually affects the keeping quality of the berries by inducing increased activity on the part of fungous diseases which cause berries to rot both on the bog and in the storehouse. In order to have sufficient drainage, it is necessary that the land on the lower side of the bog should grade down rapidly, so that the water at any time may be drawn out of the bog quickly. A ditch should be cut entirely around the bog, and other ditches are usually dug across it, dividing it into sections. If the drainage away from the bog is first class, these cross ditches are not of extreme importance unless the bottom is springy. In a naturally dry and well-drained piece of bog it is desirable that the cross ditches, if present at all, should be few and widely separated. If, however, the bog is naturally wet and difficult to drain, the cross ditches should be much closer placed. In many well-drained bogs the cross ditches are probably placed much closer together than is necessary, for the reason that water is found to travel easily and quickly through ordinary peat. Its passage through peat is far more rapid than through clay soils. On naturally well-drained bogs, therefore, the chief function of the cross ditches is to provide for the rapid distribution of water over the entire bog surface, especially in the beginning of flooding. Without cross ditches to distribute the water, the flowage tends to pile up more or less at the end of the bog where the water is admitted. The marginal ditch should be 3 or 4 feet wide and 2 feet deep. One of its purposes is to prevent upland growths from encroaching on the bog. It also prevents many kinds of insects from crawling on to the bog, and it is a considerable protection in case the bog is threatened by forest fires. It is customary to have one of the cross ditches larger than the others and running lengthwise of the bog, in the path of the direct flow of water from the brook or reservoir used for a water supply to the drainage outlet. This is desirable, as it accelerates the handling and distribution of the water in flooding and draining. Such a ditch is especially desirable on bogs of large area.

Grading.

All single bog areas should be as nearly level as possible, so that they may be flooded quickly and with as small a quantity of water as possible. The grading is done after the ditches are dug, the water line in the ditches being used to grade from. If the water supply is very abundant, it is not so necessary to be particular about getting the bog surface level as it is if the supply is scanty. The material thrown out in ditching may be used to fill up the holes formed by the pulling out of stumps or otherwise. Usually it is profitable in the long run to spend considerable money and effort in getting a bog perfectly level, and no swamp ought to be selected for cranberry purposes where it is impossible to perfect such grading at a reasonable expense, unless the water supply is ample.

Dikes.

The dams made for holding the water in reservoirs and bogs in flooding are of the sort called dikes. They are usually made of a wide core of sand faced on either side with a wall of turf. This turf may often be gathered from the upland surrounding the bog, but the surface of the swamp itself usually has to be scalped after the lumber and brush are removed, and the turf thus obtained may be partly or wholly used in facing the dikes and in walling the ditches. Unless certain malignant weeds are present to cause trouble, this turf need not, however, be removed from the surface of the swamp unless it is needed for the dikes and ditches. It may be turned upside down where it is cut instead, and when thus handled and covered with the surface mulch of sand it will give no great trouble from the weed standpoint.

The dikes are of various dimensions according to the heads of water they are required to hold. It is sometimes desirable to build the dikes wider than is necessary to hold the water, so that they may also serve as roadways across the bog. In case the bog location runs for a long distance along a stream, it is best to divide the swamp into several separate bog areas, each area nearly level in itself, but the various areas at different elevations according to the lay of the land, and all separated from each other by dikes. In this way the quantity of water required for flooding the entire swamp may be very greatly reduced. The dikes should have a broad base below the center of which a trench should be dug to hardpan. This trench should run lengthwise of the dike and should be filled with sand or gravel so as to make a good connection with the soil beneath for holding the water. The dikes should be narrower at the top than at the bottom. Heavy teams should not be allowed to drive over a new dike for several months after it is built, for the dike will be injured for holding water if it is used as a roadway before it has become well settled together. A dike should be built overstrong rather than not strong enough. In other words, it is the part of wisdom to always build a dike wider and higher than appears to be necessary. It should be at least a foot higher than the high-water mark, for the wave action of the water against it will be certain to wear a hole through the top in time in case it is not high enough. Ditches should not be dug close to the dikes, but it is desirable to ditch the bog a few feet away from the base of the dike on either side. If the ditch is cut too near to the dike there is danger of the dike caving in. If the dike crosses peat or other soft land, it should be spiled with barn boards or, better still, with planks lengthwise to hardpan, in the middle. A flume for the passage of the water must be built in the dike, and too great care cannot be used in its construction. There are several different kinds of flumes. Some are built of wood, but it will pay in most cases to build them of concrete and reinforce where necessary. The covered or trunk flume is favored by some growers of experience, and it is to be said in favor of this type that, when built of wood, it will not rot out as quickly as the open flume. When built of concrete and properly constructed, the open flume appears to the writer to be preferable. The open flume should be connected with the soil beneath and with the diking on its sides by means of plank spiling, and if the head of water to be held is very great, and the soil underneath the flume is soft and sandy, it is best to use more than one line of spiling. In the writer's opinion it is better to have the flume built so that the water may be handled from the top rather than from the bottom. It will usually be found profitable to employ a man of considerable experience in flume building.

The Form and Size of the Bog.

It is the general experience that, other things being equal, bogs of small area give much better returns than do those of large area. This is due to a variety of circumstances. Long and narrow bogs are more profitable after a certain point in size is reached than are bogs of compact form. In the first place, with large bogs of compact form, the expenses connected with the care of the bog and the harvesting of the crops are disproportionately large, particularly because it takes so much more time to wheel sand out to the center of the bog and to bring the berries to the upland from the center. Then, too, all the operations connected with harvesting and with the general care of the bog call for much more tramping over, and consequent injury to, the vines on such large blocky bogs. But perhaps more potent than these circumstances leading to the diminished success of the large bog is the fact that the flowed bog fireworm (blackhead cranberry worm) is far more prevalent and destructive, other things being equal, on such bogs. This is due to the fact that the winter flowage favors the insect by driving off from the bog most of its natural enemies such as spiders and parasites, while the water at the same time protects its eggs from unfavorable and severe winter weather conditions. The natural enemies of the insect are, of course, much slower in reaching the middle portion of a large compact bog in effective numbers than they are in reaching the same part of a small bog. If, however, the large bog is a long and narrow one, practically none of the factors here mentioned are particularly unfavorable to it in comparison with the same circumstances on small bogs in general.

Varieties.

No single bog area, that is, no area flooded by the same dike, should be planted to more than one variety. Some of the more important varieties have insect and fungous troubles which are more or less characteristic or peculiarly virulent with them, and the planting of several varieties afflicted with a variety of troubles on the same bog area often complicates the possibilities for effective treatments. There is a large number of varieties under cultivation, both on Cape Cod and in other cranberry-growing sections. Other sections may have some varieties which would be very desirable for planting on the Cape. There is always, however, the danger of the introduction of new fungous or insect troubles with the introduction of new varieties. It has been recently discovered that one disease peculiar to the Wisconsin cranberry region has been, in this way, brought to the Cape. The Early Black and Late Howe varieties are the two varieties most grown on the Cape, and they are generally considered the standard varieties there. They are fairly prolific, are well known to the trade, are among the best keepers, and their vine growth is such that they can usually be readily picked with scoops. The Early Black variety, however, is of only fair quality as a berry for the table, and the Late Howe is of rather poor quality for this purpose, being among cranberries, unless picked very late, much what the Ben Davis is among apples. The Mammoth, McFarlin, Centreville, Matthew, Centennial and Berry Berry varieties are all fancy berries and of good quality for the table, but they are, as a rule, poor keepers. Many think the Berry Berry has the best flavor of all the Cape berries at present under cultivation, and this opinion is perhaps justified. Some of the less known varieties are of fair promise, and should probably, in the opinion of the writer, be given more extended trial. The McKinley, Perry Red and Pride are here suggested as such promising varieties. The Pride is the most prolific variety of cranberries known to the writer, and it has fair table and keeping qualities and is a rather handsome berry. Its vine growth, however, is such that it will always be a difficult variety to pick with scoops.

The different varieties vary greatly in the time of ripening, the earliest usually becoming well colored by the end of the first week in September, and the latest by about the 1st of October. Some berries color up fairly well in storage, while others will not turn red very much unless they are left upon the vines. Cranberries are first green, then almost white, then pink, and finally red. There are some wild berries which are milk white when ripe, and some of the varieties under cultivation, such as the Early Black, when completely ripe, are so dark red that they are almost black. The berries of the different varieties vary greatly in shape, some being pear shaped, others elongate and pointed, and still others oval and round. Other things being equal, the round berries are to be preferred, for they are the most easily cleaned and are, therefore, most cheaply prepared for market, and will, as a rule, be shipped in the best condition.

The Construction of a Bog.

Sanding.

The first operations in the preparation of a cranberry bog, namely, the cleaning of the land of timber and brush, the turfing, the ditching and the grading of the swamp, have already been discussed sufficiently for present purposes. After these operations have been completed the swamp is ready for sanding. In this there is a variety of practice. On Cape Cod, where the sand is plentiful in banks adjoining the swamps, it has always been carried on to the bogs by men with wheelbarrows, over lines of planks. This is necessarily an expensive process, and it seems probable that it will eventually be replaced by some method of pumping, as pumping would be much cheaper and is already practiced as a means of handling sand in other similar connections. In the Pacific northwest, where the sand underlies the swamps and is not available in quantity in banks close to the bogs, some growers have successfully followed the practice of pumping up the sand in the water from the bottom with a centrifugal pump, and sending it through long lines of piping to the place where it was to be used. They have pumped sand in some cases for over a mile in this way, the cost of sanding by this method being less than $30 an acre. In former years, those who built bogs on the Cape considered it necessary to put on 5 or 6 inches of sand before planting, and this practice still prevails with many growers to-day. Those of largest experience, however, appear to have generally adopted the idea of sanding more lightly before planting, and they, as a rule, now put on only from 2 to 3 inches of sand. With this smaller amount, the vine growth is distinctly more rapid after planting, the bog becoming more quickly vined over and consequently reaching full bearing sooner. If this practice is followed, the bog should be resanded with from a quarter to a third of an inch of sand every year for the first three or four years after planting. By this method of procedure, however, a firmer and more deep-set root system will be obtained, and the bog will be kept in the best condition possible for scooping.

The sand serves several purposes: it helps to keep down weeds and moss; it fastens down the runners and enables them to root better; it gives the roots a medium to grow in which is capable of far better drainage and aeration than is peat, and thus promotes their greater development; it takes in more heat during the day than peat, and radiates it at night so as to afford a considerable protection from frost; it is a considerable aid in controlling some injurious insect pests. As the roots come to form a very dense growth in the sand over the peat, they may be said to become soil bound from time to time, and resanding gives them more soil to develop in. It has the disadvantage, however, of promoting fungous disease development more or less. It is, undoubtedly, for this reason that berries frequently rot badly on the vines in new plantings on the Cape. Berries from new plantings are generally considered weak and unfit for long shipments. Experience appears to have shown the New Jersey growers that in their climate most bogs cannot be sanded without danger of disastrous trouble from fungous diseases. On the Cape, however, if new bogs are badly diseased during the first few years after planting, they, as a rule, largely recover from it if they are kept well drained, and the advantages obtained from sanding and resanding are so great that they much overbalance this single disadvantage.

Vine Setting.

After the sanding has been done the bog is in readiness for the setting of the vines. It should be marked for planting in hills by drawing a hand-marker across it, first lengthwise and then crosswise, the marker being provided with five or more teeth. The vines should be planted in hills from 10 to 18 inches apart. About 12 inches seems to be the distance at present commended by general experience. The closer the vines are planted the sooner they will, other things being equal, come into bearing. The vines should not be bunched in the hill when planted. One or two vines are just as successful in producing a desirable growth as are half a dozen. If a lot of vines are planted in a bunch, most of those in the center, as a rule, die anyway, the result being a waste of planting material. A better method from the standpoint of vine growth, though not from the standpoint of labor involved, would be to plant several vines in each hill, but have the hill scattered, that is, have the vines separated from one another slightly in the hill. It is not necessary to set the vines right side up, for they will grow either way. The vines, after planting, need not stick up more than half an inch above the sand. A wooden or iron dibble may be used to press them in. They should be inserted well into the sand, but need not reach into the peat beneath, for most of the roots that they put out will be formed in the sand in any case.

Care of the New Bog after Planting.

Immediately after planting, the water should be turned on and held close to the surface for a day or two. This will wet up the vines and settle the sand around them. Then the water should be drawn out to the bottoms of the ditches. Except in case of very prolonged drought, a bog need not be reflowed again during the first season, and if it is reflowed it should be for only a few hours, or only enough to just wet up the surface.

New bogs should not be submerged for the winter until night freezing becomes severe enough to show signs of heaving the plants. When considerable ice forms in the ditches it is time to put on the winter flood. This should submerge the vines for several inches. In some seasons a sufficient heaving of the vines to cause considerable damage may take place as early as the 1st of November, and it is necessary to keep rather careful watch of the new planting in order to guard against this. The results of a slight injury from heaving in the early fall may not be apparent at the time, and may not, in fact, be noticed at all until the middle of the following summer, when, during a prolonged dry spell, the plants come to need a considerable amount of water. Some of the roots having been broken by the heaving of the fall before will then be unable to supply what is required of them, and a dying back of the tips, especially of the runners, will be likely to occur. In the spring, during the first three or four years, the winter flowage should be removed from a new planting about the 20th of April. At times of sudden thaws or of heavy rains, in winter or early spring, care must be taken to allow the surplus water to escape. If this is not done, and the flowage is so shallow that the vines have been frozen into the ice, the raising of the ice by the water may pull young vines out of the ground. More weeds grow on a bog during the first two or three years after planting than afterwards, for the vines have not, at that time, sufficiently covered the bog to successfully compete with them. If, however, the bog is kept free of weeds during its early youth comparatively little trouble will be experienced with them after it comes to bearing. The grower should come to understand in a general way the characteristics of the weeds with which he has to deal at this time, for it is sufficient to merely cut off the tops of some kinds and so prevent them from seeding, while it is absolutely essential that others should be carefully pulled up and rooted out. Moreover, many upland weeds, which will be entirely killed out by the winter's flooding, frequently appear on new plantings, and these need not be given any attention. After the bog has come into bearing, all weeds should be removed by the time the vines are in bloom, and if certain weeds, such as sedges, rushes, cotton grass or cut grass appear in abundance later, they should be again cleared out, even though considerable injury is done in the process of weeding. Any weeding, however, done later than the 10th of August is, to say the least, an extremely poor expenditure of time and money.

The new bog should be resanded at least twice before it produces its first full crop, so that the runners may be caused to root as they are produced each year and the vines thus develop a strong root system and become well anchored.

Care of a Bearing Bog.

After the third year the care of a bog should follow, in a general way, the following lines of practice:

The Use of Water.

The winter flowage should be put on as late in the fall or early winter as possible without running serious risks of winter-killing. As a rule, it is best not to put on this flowage until after the first heavy snow storm. This often does not occur until well into January, though the weather may become so severe as to necessitate flooding before the middle of December. In the spring, the flowage should be taken off as early as the 1st of April every other year, but it should be held as late as the 20th of May in seasons which appear to promise bad fruit-worm injury. It being difficult, however, from our present knowledge to forecast such injury, it is probably best to hold the water of the winter flood late every other year, at least in locations where the fruit worm is usually destructive. Some time during the first week in June the bog should be reflowed as a special precaution against the attacks of the fireworm, and also to clean it from any other pests which may be present in small numbers. This reflow prepares it to go through the season with a somewhere near even chance of keeping free from miscellaneous insect troubles. This reflow should, as a rule, be maintained for forty-eight hours. It should be put on during the night, and also, if possible, taken off entirely during the night, for if the tender, growing vines stand partly covered with water and exposed to the sun for any length of time they are likely to be injured by scalding. In case the winter flowage is taken off late, and the season is also cold and late, this June reflow should probably, as a rule, be postponed to some time during the second week of the month.

If frost threatens to do damage during May or the first half of June, it will be necessary to put on a partial flood for protection against it. It is not necessary, however, to entirely cover the vines for frost protection. Two or three inches of water over the surface of the sand under the vines is entirely sufficient for this protection, as the water will radiate its heat into the air and maintain a sufficiently high temperature around the vines to keep them from freezing. Bogs are flooded both by gravity flowage and by pumping. With many bogs, however, there is not sufficient water supply for reflowage or even, in some cases, for winter flowage. On such bogs, if they are not located in exceptionally cold places, protection from frost may be had at reasonable expense by the use of tobacco shade cloth.

The bog should not be reflowed during or after the blossoming period except in cases of extreme need, such as protection from a forest fire or a threatened insect devastation which evidently could not be averted in any other way. In September and October the fall period of frost danger often makes it necessary to again flow the bogs for protection. The berries and vines will, however, endure some frost at this period of the year, and longer chances may be taken than during the spring period of danger. It is not desirable to flood in the fall for protection if it can be avoided, for the water tends to cause a deterioration in the keeping qualities of the fruit. It should be stated, in this connection, that it is best not to flood for frost protection either in the spring or fall unless it is certainly necessary, for the water at either period of the year will do a certain amount of harm. The United States Weather Bureau maintains a frost-warning service for the benefit of the growers during both of these periods, and warnings may be had from the office in Boston when they are needed by any grower if he has a telephone and will make his wants known. It is not wise, however, to always rely absolutely on this service, but most growers could save their bogs from many a flooding, and at the same time save their water supply to meet their greatest needs when such supplies are not abundant, by making a more careful study of weather conditions, especially in connection with the dew point and the action of the barometer.

After the crop is harvested, the bog should be completely reflowed for five or six days. This helps the vines to recover from the shock of the tearing up which they receive during the process of harvesting. It also destroys whatever girdler worms may be present on the bog, if the water is put on before the 1st of October. No reflowage after this one is necessary or desirable before the water is put on for the winter.

Irrigation.

There is a variety of practice in connection with the irrigation of cranberry bogs, and it is by no means certain what the best practice is. A bog can be given altogether too much water during the growing season, and most growers probably err more in this direction than in running their bogs too dry. It is evident, however, that in periods of prolonged drought a bog can be run so dry as to cause it injury. In case of doubt, it is probably best to take a middle course and try to be sure that the vines have enough water but not too much. If the sand is moist up to within half an inch of the surface, even though the surface itself appears perfectly dry, it is pretty certain that the vines have all the water they need, even if the water table appears to be very low.

The Use of Sand.

Experience and investigation seem to indicate that resanding should be done every other year on a bearing bog. The oftener it is done the more of a protection it is against frost, the girdler and the tip worm. If it were not for these three factors, it would probably not be desirable to sand oftener than once in three years. There is a difference in opinion in regard to the best season of the year for sanding. Some, with the writer, hold that the fall, after harvesting is done, is the best time for this work. Others consider that the sand may be applied most cheaply, evenly and effectively on the ice during the winter. Still others believe that it is best to sand in the early spring after the winter flowage has been let off. Sanding may sometimes be done most cheaply in the winter, although weather conditions would affect the cost. Certainly the process of sanding will do the least possible mechanical injury to the vines if the sand is put on the ice. This mechanical injury is undesirably great in the spring, but the sand is, of course, somewhat cleaner for the following season if it is applied in the spring. There is usually, however, not so great a rush of work in the fall as in the spring, and labor is, therefore, usually more abundant, and better attention can be given to the work at that time of the year. Moreover, the injury done to the vines at that season is not very great. The cost of thorough resanding with from a quarter to a third of an inch of sand varies from $20 to $30 an acre.

Pruning.

Sometimes vines become undesirably thick and dense. This may be due to a variety of reasons. It most often occurs on new bogs where the bottom is very rich and the sand mulch comparatively thin. Under such circumstances it is probably best to thin out the vines by the use of knife-rakes and then sand the remainder heavily. With the exception of this treatment for the improvement of heavy vine conditions, pruning as a general practice on cranberry bogs is probably not to be recommended. It is sometimes desirable, however, to thin out loose runners by a very light use of the rakes.

Fertilizing.

Extensive experiments with fertilizers have been carried on for several years, but it has not yet been definitely proved that there is any great advantage to be had from their use from the standpoint of fruit production. There appears to have been no decided increase in the quantity of fruit due to the use of fertilizer, except where some form of nitrate has been used, and in this connection it is probably safe to recommend for many bogs the use of nitrate of soda in moderate quantities (100 pounds to the acre). The best results from the use of this fertilizer are to be expected on portions of the bog which for any reason are thin vined, especially on the portions over "hard bottom" (sand or clay underneath instead of peat). Such fertilizing on new bogs is probably entirely undesirable except on "hard bottom." Vine growth is always accelerated by the use of nitrate, and this acceleration is likely to be undesirably great on peat bottom, especially if the bog is new.

Fungous Diseases.

There are numerous fungous diseases which affect cranberry vines. Some of them seriously affect the vitality of the vines and some reduce the crop either by blasting the blossoms and young berries or by causing the decay of the larger berries both on the vines and in storage. As has already been indicated, the use of sand encourages the development of such diseases, but it is so great a help in other directions that it must be used in spite of this difficulty. One of the best ways to reduce trouble from fungous disease is to maintain good drainage during the growing season. For this reason, bogs which are troubled seriously by such diseases should be kept as dry as they safely can be throughout the summer, after the winter flowage has been taken off. It seems to be the general experience on the Cape, however, that late holding of the winter flowage (to the 20th of May) markedly improves the keeping quality of the berries. Care in the handling of the fruit during the harvesting, and in the processes of separating, screening and packing for the market will certainly do much to keep down the rotting caused by fungous diseases during transportation. The matter of spraying bogs for the curtailment of fungous diseases is, at present, in a condition of confusion. It is found that Bordeaux mixture, made according to the formula which is used in New Jersey, and which has been recommended by the experts of the Bureau of Plant Industry of the United States Department of Agriculture, apparently causes a cumulative injury to the root system of the cranberry when used on Cape Cod. It is to be hoped that some modification of this formula will in time be found which will not cause this injury, and which can be safely used to keep down fungous diseases on the Cape bogs. Spraying is found to be uniformly successful in improving the keeping qualities of the berries and in reducing the rot on the vines.

Insect Pests.

There are several serious insect pests which affect the cranberry. The more important are the following: the fruit worm, the flowed bog fireworm (blackhead cranberry worm), the tip worm, the girdler and the dry bog fireworm (yellowhead cranberry worm). These pests are here named in the order of their apparent importance. The first two are by far the most important. The fruit worm alone has been known, in some seasons, to destroy as much as an estimated third of the entire Cape crop. The only certainly efficient remedy for this insect at present known is late holding of the winter flowage in the spring (to the 20th of May). It is not desirable, however, to practice this late holding every year on account of its effect on the vines, and it is therefore recommended that this flowage be held late every other year as a regular preventive practice against this insect. The flowed bog fireworm never attacks strictly dry bogs seriously, and it may be prevented from developing a serious infestation on any bog with an abundant water supply by means of an annual June reflowage, as already recommended in another place. On large bogs which can be reflowed, but on which the reflowing is not regularly done on account of the impossibility of handling the water quickly, it is probably best to follow the practice of compelling the eggs of the insect to bunch up in their hatching, by holding the winter flowage late (to about the 1st of June), and then reflowing about three weeks later. On bogs which are winter flowed, but cannot be reflowed at all, spraying with arsenate of lead is, at present, the only remedy which can be recommended without qualification.

When very abundant, the last brood of the tip worm can do serious injury by reducing the bud formation from which is produced the crop of the following season. Investigations seem to have indicated that ordinary resanding, if done frequently enough, is a satisfactory preventive of trouble from this insect. On this account it is recommended that resanding be done every other year.

As already indicated, reflowing after picking is a satisfactory method of treating the girdler where water is available. This insect will not get in, as a rule, on bogs which cannot be reflowed, if they are kept well sanded. It seems to like to work in the rubbish of an unsanded bog in thick vines. If a serious infestation is already present, resanding evenly with a full inch of sand either in the fall or in the spring before the first of June is usually sufficient to smother the insect so that the moths will not emerge.

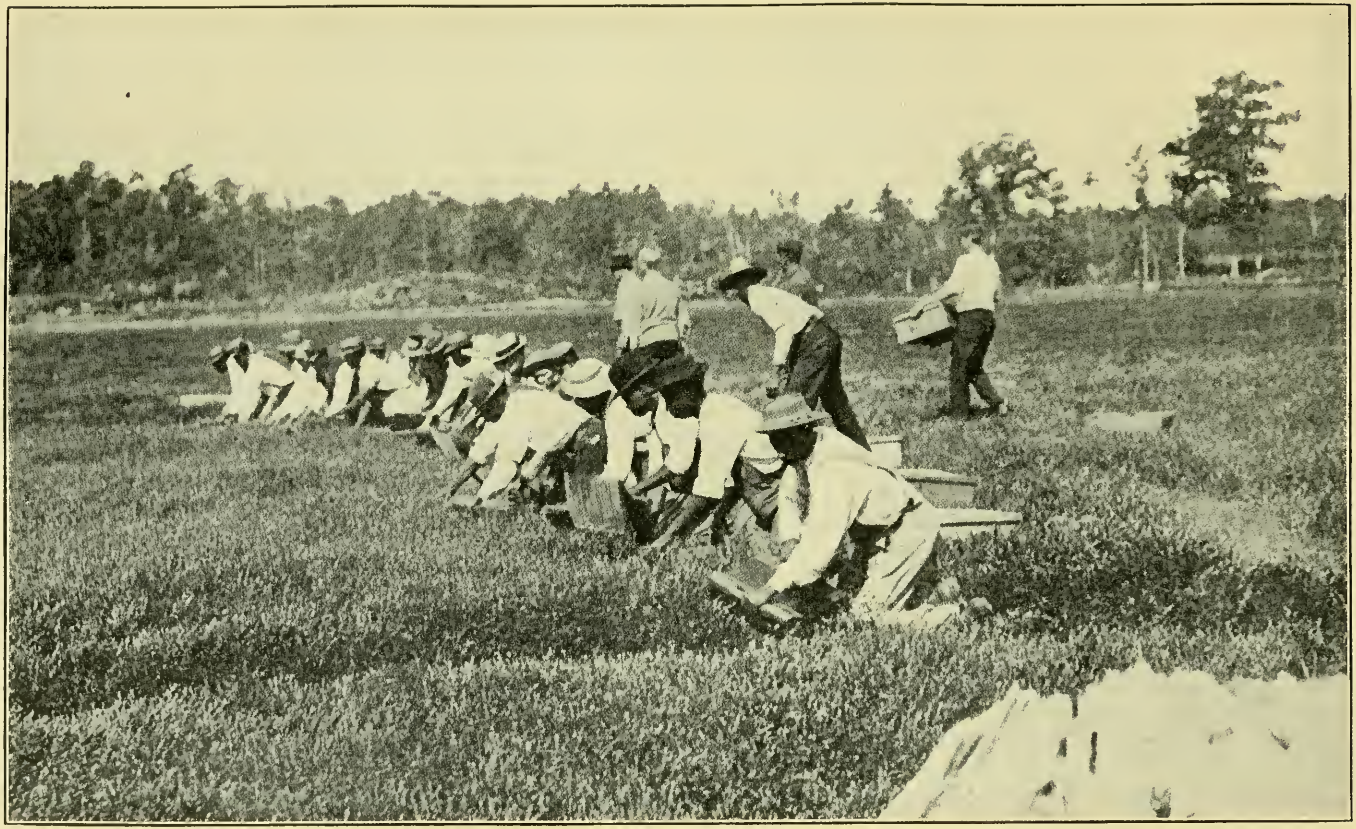
The dry bog fireworm is easily controlled by a single spraying with arsenate of lead, applied between the 4th and 10th of July. On the Cape this insect seriously affects only such bogs as are not winter flowed.

Harvesting.

In average seasons the cranberry harvest begins during the last week in August and continues until the crop is entirely gathered. The length of the picking season varies greatly in different years, according to the weather conditions. Cranberries should be picked only in dry weather. It will not do to begin picking in the morning until the vines have thoroughly dried off, and the day's picking must be finished before the dampness of the very late afternoon begins to gather. Frosty nights, as well as wet weather, are a hindrance in the picking season, for they compel the flooding of unpicked areas and, as a rule, no picking can be done on the day following flooding. Cranberries were originally picked entirely by hand, and quite an army of pickers was needed to gather the crop. With the acreage at present under cultivation it would be practically impossible to gather the entire crop by hand on account of scarcity of help. There is, however, considerable hand picking still done, especially by the small growers. If berries are picked carefully by hand, this method probably causes the least possible injury to the vines. It is, however, a very expensive and probably unwise method to follow, except, perhaps, on the thin vines of new plantings, the berries of which are likely to be tender and should be injured as little as possible.

Most of the crop on Cape Cod is, at present, picked with rakes, or scoops as they are more commonly called. Scooping is also largely practiced in Wisconsin. Hand picking, however, is the rule in New Jersey. With average crops, berries may be gathered with scoops at an average expense of from 40 to 50 cents a barrel. With very heavy crops, berries have occasionally been scooped for as little as 9 cents a barrel. They can hardly, however, be gathered at so little expense, even under the most favorable conditions, without great waste, too large a percentage of the fruit being left on the bog under the vines when the scoopers are rushed, especially when the crop is heavy. There is a general tendency among the growers to hasten their pickers, with the idea of harvesting at as small an expense as possible. This tendency, however, is to be deplored, for the old saying that "haste makes waste" has no more appropriate application than in this matter of picking cranberries with scoops. The scoopers should be made to work rather slowly especially if the crop is heavy. To have the men work steadily, without haste, and scoop with as little waste as possible, without picking up by hand any of the berries that fall to the ground, is probably a good rule to follow. On large bogs, if help is scarce, it is, however, probably best to harvest the crop as rapidly as possible so as to save it from frost damage, even though the waste is great. Prevailing prices also have a bearing on the comparative wisdom of slow and rapid scooping; $3.50 a barrel net would justify rapid scooping in any case, but $4 or more net makes slow, careful work desirable. The berries that fall to the bottom and are left on the bog should not be gathered by hand, for they will not sell for enough to pay the expense of handling. They are always in poor condition, having been tramped over more or less, and are certain to decay badly if gathered. Such berries are sometimes gathered from the water when they float up on the after-picking reflow. Only a small portion of what is left on the bog will, however, float up in this way, and if they are gathered, it is almost an endless job to get them dry and keep them so. In general, therefore, it is probably best not to bother with such berries at all.

Women and children help freely in hand picking, but only men should be engaged for the heavy work of scooping. It is probably best to pay the scoopers by the hour, without attempting to hasten their work by means of bonuses for extra quantities picked. The usual wage for scoopers is 35 cents an



Cranberry scooping. At this spot there were two barrels to the rod, and twenty men picked five hundred barrels in five and one-half hours.
(Published by permission of the United Cape Cod Cranberry Company.)

hour, though the larger growers are sometimes able to hire them for as little as 25 cents.

Small hand-picking machines, known as "snap machines," are frequently used for gathering the berries on thin vines instead of picking by hand. These are very useful, for they gather the berries comparatively quickly and cheaply and without much injury to the vines. They do, however, injure the fruit more or less seriously and impair its keeping quality.

Marketing conditions are such, and the possible harvesting period is so short, that it is probably necessary, especially if the season is late, for many growers to begin picking while the berries are still partly green. Many believe that very ripe berries will not keep well, but it is to be seriously questioned whether they will not keep as well on the vines, if they are protected from frosts, as they will in the screen house. Between the 1st and the 15th of September, during the period of coloring, berries of the Early Black variety will increase 10 per cent., and sometimes more, in size. They make a much more attractive appearance and are of much better quality for the table after they have become colored. Probably many growers would, therefore, be wise to postpone their picking for two weeks later than is their present custom. Early Blacks for late shipment should probably not be picked before the first of October, for late picking would largely prevent the loss by shriveling, which is usually considerable if the berries are picked early, and then held in storage for some time.

Berries which grow on vines bordering the ditches are generally considered to be, as a rule, poorer keepers than those from the other vines. These "ditch row" berries, as they are called, should, therefore, be gathered first, and be packed and shipped separately from the rest of the berries. It would probably be a good practice to devote the first day of picking to the gathering of all the "ditch row" berries of the early varieties on the bog to be picked. They would then be out of the way, and it would be unnecessary to keep further track of them.

To harvest a 15-acre bog, 15 scoopers, a foreman and three helpers are necessary. Two of these men are engaged in taking the berries off from the bog and piling them up in boxes on the upland where they may be taken away by team. An ideal way to remove the berries from a bog is yet to be devised. Hand barrows or stretchers are probably most commonly used, and this method is fairly satisfactory, but it seems expensive. Ordinary wheelbarrows are often used, both with and without planks. The trouble of moving the planks, however, is considerable, and if they are not used, the vines are likely to be killed out more or less in paths by the constant rolling of the wheelbarrows over them, for it is very difficult to keep the men who are wheeling the berries from following paths. Probably some form of hand truck might be devised which would give better satisfaction than anything at present in use for this purpose.

As they are picked, the berries are dumped into bushel boxes on the bog, the slats of the boxes having more or less space between them to allow for a circulation of air through the berries which they contain. As the scoops gather more or less vines, these are dumped into the boxes with the berries, no great pains being taken to clean them out. It is generally supposed that the berries keep better in storage if a considerable quantity of vines and chaff are allowed to remain in the boxes with them, the idea being that the vines increase the possibilities for air circulation. It seems very doubtful, however, whether the presence of the vines has this supposed effect to any considerable degree, and it is certain that no conclusive tests have been made which prove any such effect. Probably this idea sprang from the fact that, after berries have been run through the separator and screened they decay comparatively rapidly in storage. This deterioration in keeping quality is, however, evidently very largely due to the injury the berries receive during those processes of cleaning. After harvesting, the vines should all be raked hard in one direction with ordinary hay rakes. This raking clears the bog of loose vines left torn up by the scoops and it trains the vines that are left for scooping the following year.

Screen House.

After being poured into the bushel boxes, the berries are stored in the packing house (screen house). This building should be capable of thorough ventilation. On damp days it should be kept close shut, and on dry, sunny days it should be thoroughly ventilated. It should have ample capacity for storing two-thirds of the maximum crop that may be expected from the bog and the barrels for packing as well as room for separating and screening the berries. A building of one floor, 40 by 80 feet, should be sufficiently large to accommodate the berries of a heavy crop from a 12-acre bog.

Preparation of the Berries for Market.

The first shipments are usually made within a week after picking begins, in early September, and the greater part of the crop is sold by the 1st of December, though a considerable quantity of berries is often in the hands of the growers until well into the winter. Some growers prefer to take the lower prices which the earlier shipments bring and get rid of their berries as soon as possible. It is to be said in favor of this attitude that their shipments do not suffer from shrinkage due to rot and loss of water as do the late shipments, and the cost of screening and packing is also much less than it is with the berries which are shipped late. Berries which are held until into the winter, however, usually bring much better prices, and some growers prefer to hold their fruit late and suffer the incidental losses for the sake of obtaining these higher prices.

In preparing for market, the berries are first run through a machine known as a separator. There are a number of makes of these machines on the market. Those most used on Cape Cod are provided with a hopper at the top for receiving the berries, a blower for cleaning them of chaff, and several bounding boards for separating the decayed from the sound fruit. Some of the machines also have other useful accessories, such as endless aprons and grading devices. If the berries have not been badly worm-eaten or decayed on the bog to any extent they may be packed for shipping as soon as they have been put through the separator, and the early shipments are often handled to a considerable extent in this way. Most of the berries, however, have to be screened by hand after they have been run through the separator. Women are employed to do this work, and there is a variety of makes of screens for this purpose. "Screeners" are usually paid $12\frac{1}{2}$ cents an hour for their work.

It is best not to screen or pack fruit on wet days, for the berries are likely to absorb moisture on such days, and if they are packed moist they are far more likely to rot in transportation. Most of the berries are packed in barrels of standard dimensions which are guaranteed by law to contain a certain amount of fruit by weight. These barrels should contain approximately 85 quarts each. Bushel crates are often used satisfactorily in making small shipments. If barrels are used they must be shaken and well pressed down in the process of heading so that they may not be found in the market to be "loose packed." "Loose packed" barrels are shunned by the trade, both because of their lack of a full quantity of fruit and because the thrashing around of the fruit in a loose pack seriously impairs its keeping quality.

Marketing.

According to conditions, the opening price of cranberries in the fall ranges from $4.50 to $5.50 a barrel. About 60 per cent. of the Cape crop is sold through a co-operative selling agency known as the New England Cranberry Sales Company, with its office at Middleboro, Massachusetts. Other sales companies in Wisconsin and New Jersey, affiliated with the New England company, handle the greater part of the berries grown in those sections. This selling agency is now well organized and managed, and it helps the trade tremendously by keeping track of the cranberry situation and markets in different parts of the United States and Canada and distributing the berries as they are needed, thus preventing gluts in the market as far as possible. It maintains a corps of inspectors, and the berries handled by it are packed uniformly, under different brands, according to their varieties and qualities, a stability in the selling arrangements being thus maintained all the way through.

Many growers, however, prefer to be free to sell their berries without any dictation as to packing and marketing. Most of the fruit sold by growers outside of the sales companies is probably disposed of through commission men, and there are buyers for cash also on the ground, more or less, every year.

Preserving.

Various efforts have been made by some of the larger growers to preserve the fruit which cannot be immediately placed on the market. Methods of canning and evaporating have already been considerably developed, and preserving in one of these ways is likely, in time, to become an established part of the business. As a matter of interest to housewives, it should be stated here that cranberries can be kept fresh and in good condition for several months by keeping them submerged in cold water in sealed jars in a cool place. It is important to wash the fruit thoroughly and sort out the decayed berries, before the fruit is thus submerged.

Cooking.

Cranberries should always be cooked in earthen, agate or aluminum kettles. The strong acids of this fruit act so quickly upon tin, iron or brass that kettles made of these metals should never be used. Cooked cranberries should not be allowed to stand in dishes made of metal which their acids will affect. Only granulated sugar should be used to sweeten this fruit. There is probably a considerable difference in the quantities of sugar required to sweeten the fruit of the different varieties. The riper the berries are when picked the smaller the amount of sugar they are likely to require.

A few recipes which have been found particularly good for the preparation of cranberries for the table are here given. These recipes are from a handbook published by the New England Cranberry Sales Company.

Sauces.

No. 1. — Take 1 quart of cranberries, 1 pound of sugar, 1 pint of water. Boil sugar and water together for five minutes; skim; add the cranberries and cook slowly, without stirring (turn and shake the pan if necessary), until all the berries have cracked their skins, and so become sweetened. Remove from the fire when the popping stops.

No. 2. — Take 1½ cups of boiling water, 1 quart of cranberries, 1½ cups of sugar. Boil together for fifteen minutes without stirring, but watch carefully to prevent burning (shake and turn the pan, if necessary), the object being to preserve the fruit as nearly whole as possible.

No. 3. — Take 1 quart of cranberries, 1 pint of sugar, 1 pint of water. Put berries and water in a pan and spread the sugar over the floating berries; cover closely and cook for ten minutes without stirring. Do not let them burn or boil over; shake and turn the pan occasionally. Skim with a silver or porcelain spoon, and set back on the stove to simmer for a few minutes. Cooked in this way the skins will be tender, the berries nearly whole but sweetened, the juice clear and almost a jelly.

Jellies.

No. 1. — Take 2 quarts of cranberries, 1 quart of water. Boil until the cranberries are tender. Strain through a jelly bag or thin muslin. Heat the juice, and to each pint of juice add from ¾ of a pound to 1 pound of granulated sugar, according to taste. Stir until the sugar is dissolved, but do not boil. Pour into jelly glasses or molds.

To make a firm jelly, boil a quart of berries with 1½ cups of water until the skins burst. Press through a sieve and reheat. When at the boiling point, add 1 pint of sugar and boil for ten minutes, then turn quickly into wet molds.

No. 2. — Wash 1 quart of selected berries. Sprinkle over them 1 pint of sugar and ½ pint of water. Cook slowly. When they begin to boil, cover over a few moments and cook until tender, but do not allow the skins to break. Pour into a mold. The juice will be firm, inclosing the berries, which makes an attractive and delicious dinner accompaniment.

Pies.

No. 1. — A delicious pie is made of 1½ cups of split raw cranberries, 1 cup of sugar, ½ cup of water. Put into porcelain-lined vessels and cook ten minutes. Cool and bake in one crust with a rim and strips across the top. This may also be cooked with rich upper crust if desired.

No. 2. — Take 1½ cups of cranberries, ¾ cup of seedless raisins, 1 cup of granulated sugar, 2 tablespoons of flour, 1 teaspoon of vanilla, and a few drops of almond flavoring. Bake with two crusts. It is better to cook berries in water a few minutes.

No. 3. — Take 1 cup of split, raw cranberries, ½ cup of seeded raisins chopped fine, 1 cup of granulated sugar, 1 tablespoonful of flour, very heaping, 1 teaspoonful of vanilla. Use a short pie crust and bake slowly.

WATER ICE.

Boil 1 quart of cranberries in 1 pint of water until the skins are soft, and strain through cheesecloth. When cool, add the juice of 2 lemons. Make a syrup with 1 pint of granulated sugar and ½ pint of water; when cool, add to the cranberry juice and freeze.

Many persons add 1 tablespoonful of gelatine which has been soaked ten minutes in ½ cup of cold water.

PUNCH.

Boil 2 cups of water and 1 cup of sugar together fifteen minutes; boil 1 pint of cranberries and 1 cup of water together five minutes, strain through cheesecloth, add the syrup and juice of a lemon, cool, freeze to a mush, using equal parts ice and salt; serve in glasses.

THE COST OF BUILDING A CRANBERRY BOG.

Cost per acre for land,	$10 to $100
Clearing, ditching, turfing, grading and sanding,	200 to 500
7 barrels vines at $3 per barrel,	21 to 21
Setting out of vines,	16 to 16
Incidentals (tools, dikes, flumes, buildings, etc.),	150 to 250
Total,	$397 to $887

The cost of building will depend on a variety of circumstances, but particularly on the natural conditions, make-up and location of the swamp which is to be converted into bog, and on the ability and knowledge of the foreman who superintends the work. An average yearly yield of from 50 to 65 barrels of berries per acre may be expected from a good piece of bog, properly built and located, planted with standard varieties and given proper care.

A good bog, planted with standard varieties and given proper care, barring the accident of fire, ought to bear crops more or less regularly for a long period of years. There are bogs now forty years old on the Cape which are still in fine condition and bearing well.

THE ARMY WORM.

(*Heliophila unipuncta,* Haworth.)

H. T. FERNALD, STATE NURSERY INSPECTOR, AMHERST, MASSACHUSETTS.

The army worm is widely distributed over the United States and from time to time causes considerable loss. Usually it is not abundant, but after a period of a dozen or more years it suddenly appears in large numbers, feeding upon various plants, and marching in armies attracts much attention. The season of 1914 was one of its years of unusual abundance in Massachusetts, and this has led to many inquiries about the insect, its habits, methods of control and the chances that it may reappear another year. These inquiries have led to the publication of this paper.

History.

Records of previous years of abundance of the army worm in Massachusetts are not as complete as could be desired. Nevertheless, old diaries and journals give some evidence as to early periods of abundance in New England, which may be of interest. Flint summarizes weather and crop conditions from records from various sources. Here we learn that "the next dry summer was in 1666, when most of the grain was scorched up and the Indian corn eaten by the worms. In 1743 there were millions of devouring worms in armies, threatening to cut off every green thing. In 1770 'a very uncommon sort of worm called the canker worm ate the corn and grass all as they went above ground which cut short the crops in many places.'" As the true canker worms feed on the foliage of trees, the use of this name here is manifestly incorrect. This appearance of the insect is also recorded by Noah Webster, and in more detail by

Powers, as follows: "In the summer of 1770 this whole section of country was visited by an extraordinary calamity. . . . It was an army of worms which extended from Lancaster, New Hampshire, to Northfield in Massachusetts. They began to appear the latter part of July, 1770, and continued their ravages until September. The inhabitants denominated them the "Northern Army," as they seemed to advance from the north or northwest and pass east and south, though I do not learn that they ever passed the high lands between the Connecticut and Merrimack rivers." The caterpillar had "a stripe upon the back like black velvet; on either side a yellow stripe from end to end; and the rest of the body was brown. . . . There were fields of corn on the meadows in Haverhill and Newbury standing so thick, large and tall that in some instances it was difficult to see a man standing more than a rod in the field from the outermost row; but in ten days from the first appearance of the Northern Army nothing remained of this corn but the bare stalks! . . . About the first of September the worms suddenly disappeared. . . . In just eleven years afterward, in 1781, the same kind of worm appeared again, and the fears of the people were much excited, but they were comparatively few in number, and no one of the kind has ever been seen since." Webster states that in 1790 large numbers of army worms appeared in Connecticut and were very destructive.

In 1817 this insect appeared in Worcester County in great abundance, and again in many places in 1860 (Fitch). Fitch's report, though dated 1860 and published in 1861, contains some internal evidence that events which occurred in 1861 may have been included, and it is probable that the invasion was in the latter year, as was the case in Massachusetts and in the country at large. Round records the appearance of the army worm in 1882 in Massachusetts. The next appearance of the insect in this State was in 1894, when it was abundant in the southeastern part of the State, and in some towns in Franklin County, followed in 1896 by its general abundance throughout New England. This was the last time the insect was abundant until the present season (1914), when it has been very generally present over southeastern Massachusetts, in a number of towns north of Boston, in some parts of Worcester County, and in Longmeadow.

It should be noted that particularly in the case of some of the older records given above the absolute identity of the insects concerned with the army worm is not conclusive. The probability of their being the same, however, is so great as to leave little doubt.

The Present Invasion.

During 1914 reports of the presence of the army worm began about the 20th of July and continued until about the 10th of August. These reports were mainly from points south of Boston and east of Mansfield, and the insects appear to have been most abundant in the southern part of Plymouth County and in Barnstable, Dukes and Nantucket counties. From these reports the following list of towns in which the insect was reported has been prepared, much information on this point having been obtained by the kindness of the State Forester's office: —

Abington.
Arlington.
Athol.
Attleborough.
Barnstable.
Berkley.
Boston.
Bourne.
Braintree.
Brewster.
Brighton.
Brockton.
Carver.
Chatham.
Chelmsford.
Cohasset.
Dartmouth.
Dighton.
Duxbury.
East Bridgewater.
Easton.
Edgartown.
Fairhaven.
Fall River.
Falmouth.
Gloucester.
Halifax.
Hanover.
Hanson.
Harvard.
Harwich.
Hingham.
Holbrook.
Hyannis.
Longmeadow.
Mansfield.
Medford.
Middleborough.
Milford.
Nantucket.
Newbury.
North Andover.

Northbridge.
Norton.
Norwell.
Oak Bluffs.
Pembroke.
Plymouth.
Plympton.
Raynham.
Rochester.
Rockland.
Rockport.
Salisbury.
Scituate.
Seekonk.
Somerset.
Swansea.
Taunton.
Tisbury.
Topsfield.
Wareham.
West Boylston.
West Bridgewater.
Weymouth.
Whitman.
Worcester.

LIFE AND HABITS.

The life history of this insect varies in different parts of the country. In the south Dr. L. O. Howard considers that there may be as many as six generations a year. In New England the evidence indicates two generations, although possibly there may be but one in some portions of Massachusetts, this point not having been conclusively settled. Under these circumstances only a general outline of the life of the army worm can be given.

It appears probable that in Massachusetts these insects pass the winter as partly grown caterpillars, which resume their feeding the following spring and upon reaching full size go a few inches into the ground and there transform into dark brown pupæ (Fig. 1), in which condition they remain for two or three weeks. At the end of this period the insects have changed to moths which escape from the ground and fly at night, laying eggs for the next generation. The moths (Fig. 1) spread about an inch and a half and are rather uniformly brownish or reddish brown, with a single small white spot near the center of each fore wing above

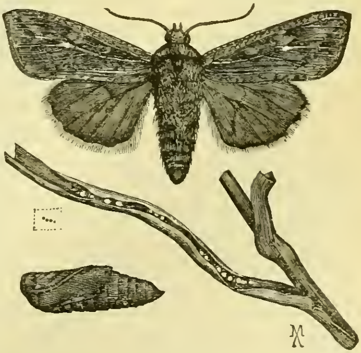


FIG. 1. — Adult army worm moth; eggs in grass sheath; pupa. (From Report of United States Department of Agriculture, 1879.)

and a small black spot near the center of each hind wing beneath.

These moths lay their eggs (Fig. 1) in rows of about twenty in a place, in the sheaths of the leaves of various grasses and grains, or on stubble, straw stacks, etc., several rows being sometimes placed on the same plant. The total number of eggs laid by a single moth is perhaps five or six hundred. These eggs probably remain a week or ten days before hatching into tiny caterpillars which feed upon the plants. The time spent in this stage varies under different conditions, but it is probable that a month would be about the average. When full grown, the caterpillar (Fig. 2) is about an inch and a half long, with a velvety black band along its back from head to tail. At each side of this band is a narrow yellowish stripe, then a brown one, and lastly — nearly down the side to the legs — another yellowish stripe. These colors vary greatly, however, the most distinctive marking being the velvety black band on the back with the lighter band at each side.

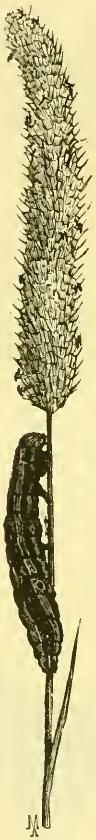
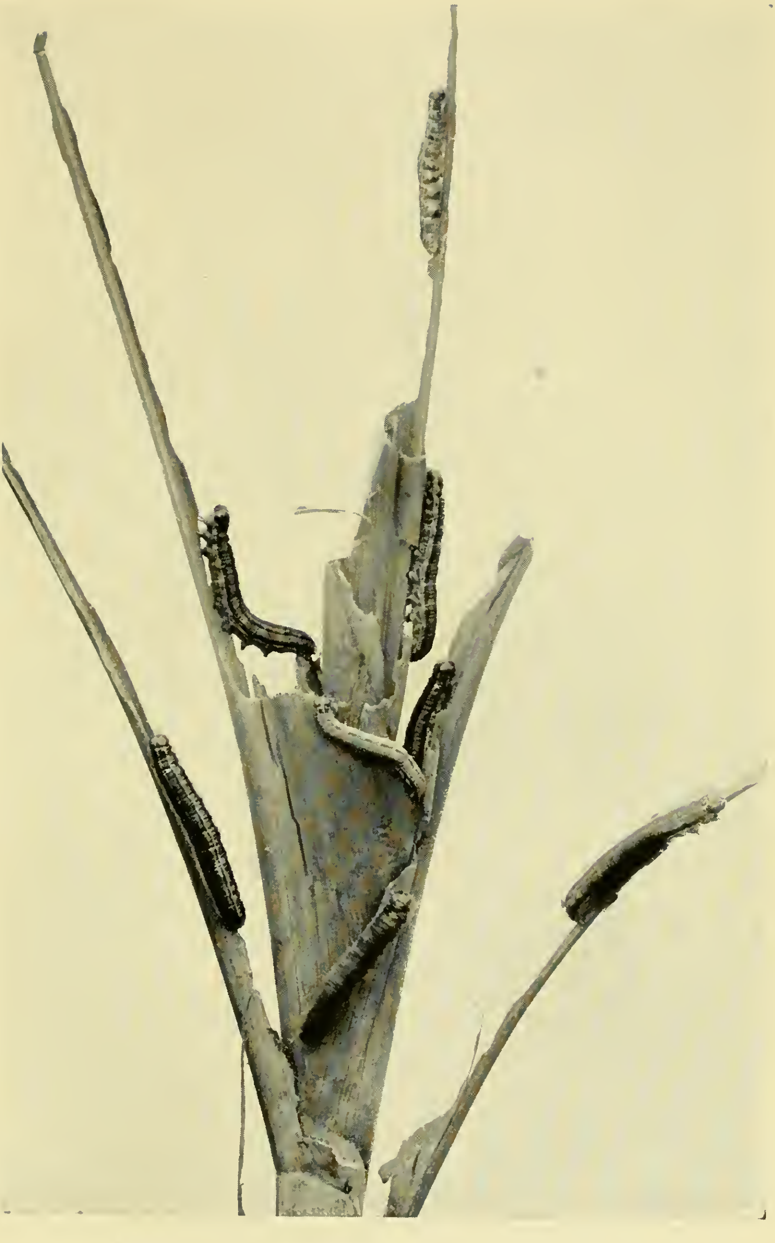


FIG. 2.—Caterpillar of army worm. (From Report of United States Department of Agriculture, 1879.)

When through feeding, the caterpillars go into the ground, pupate and transform into moths, as already described for the earlier brood. The moths soon appear (they appeared the last of August and early in September in 1914) and lay their eggs, and the caterpillars from these feed for a time before winter, resuming their feeding in the spring. The moths this year were very noticeable toward night, feeding on honey dew on pear leaves where it had been left by the Pear Psylla, which was very abundant.

From this outline, it is evident that the caterpillars feed late in the fall and early in the spring in one generation or brood, and during the summer in another. It appears to



Caterpillars of army worm feeding on corn. (From Slingerland.)

be always the latter generation which causes the devastation and which marches in armies at times, giving the insect its name.

The army worm appears to feed generally in low meadows, near swamps, and where various grasses have rank growth. Its appearance in large armies is not a usual or normal thing, but seems to be due to the exhaustion of its food or to such great abundance as to force it to spread to other places. In this spread the caterpillars all march in the same direction until new food supplies are available, where they continue feeding. The direction of the march varies in different localities. Though usually feeding only on grasses and grains, under the pressure of hunger, it may attack peas, beets, lettuce, cabbage, cauliflower, pigweed, cranberries and other plants.

Losses and Methods of Control.

The army worm may be very abundant without its presence being known, when it is feeding on low and neglected lands, around swamps and such places. When it leaves these localities, though, and marches off in search of more food, and particularly when it reaches and begins to attack some crop of value, it is quickly noticed, and its abundance usually develops the fear that the loss will be very great.

The present season has illustrated this condition. Reports of enormous losses have been numerous from many places, but personal visits to some of these have failed to indicate any very great amount of destruction. Examination of many places where the loss was estimated at as much as $500 leads to the opinion that one-fifth of this amount would be more nearly correct.

A member of the State Board who visited various parts of the towns of Bridgewater, Middleborough, Wareham, Carver, Plympton and Plymouth during the height of the invasion this year has supplied the following statement: —

> At the Bridgewater State Farm the army worms were very numerous, though Mr. Bacon, the farmer there, stated that the attack was not as bad as in 1896. The greatest injury was to oats and grass, and

would perhaps reach $500. There were several smaller outbreaks in Bridgewater, but with slight money loss. Middleborough had numerous though small outbreaks, the total loss being estimated at $300. In Wareham some lawns and small fields of grass were injured, the estimated loss being less than $100. Reports of damage to cranberry bogs in Carver failed to be supported on investigation; a few mowing fields attacked indicated a loss of perhaps $100. In Plymouth no places were found where the insect was causing any appreciable injury. In these towns the whole question of damage has been much overestimated without question, for all cases reported were followed up and always found to be much exaggerated.

When the army worm is discovered in abundance, in its usual low-ground or swampy haunts, it may be controlled by spraying there with Paris green or arsenate of lead. If the former material be used, as much as 3 pounds of the Paris green to 75 gallons of water should be used; if arsenate of lead be taken, at least 5 pounds to 50 gallons of water should be used. In either case the object of this is to destroy the caterpillars before they start to march to other fields, and after a treatment as strong as this the grass, or whatever the plants may be, cannot be used. Paris green at the strength named will probably burn the plants later. This treatment, then, sacrifices the grass, or whatever the caterpillars may be feeding upon, for the purpose of destroying the insects before they start for more valuable crops near by.

When the insects are discovered on the march, or actually at work on growing crops, the method of control must be chosen to meet the particular conditions present in each case. If they are marching to a grass field, a strip across and just ahead of the line of march can be heavily sprayed as directed above. This particular strip will of course be at least partly eaten by the army, and anything remaining would be so heavily poisoned that it would be unsafe to feed to stock. But in this way protection for the fields beyond may be obtained. Sometimes it is possible to place a thick strip of Tarvia (road oil) across the line of march. This should be kept fresh and renewed when necessary; sometimes a furrow plowed across, throwing the earth toward the army, is quite effective, the caterpillars finding it difficult to crawl up the vertical side of the furrow, and crawling along it instead. About every 10 feet along the furrow a small hole should be dug in which the caterpillars collect, and where they can be destroyed by crushing or pouring in kerosene or quicklime. A band an inch or more deep of powdered lime (agricultural lime) has proved quite an effective barrier in some cases this year, and in others better results were obtained by plowing the furrow so as to throw the earth out on the side away from the caterpillars. In any case a furrow to be effective must be thoroughly dry. The dust band so frequently recommended did not prove satisfactory.

Excellent results attended the use of a bran mash bait. This was prepared by taking 1 pound of Paris green, 25 pounds of bran or middlings, 2 quarts of cheap molasses, and water to make a thick mash when thoroughly stirred. This was placed in strips across the line of march or spread broadcast, and the caterpillars fed freely upon it. The drawback to this method is that fowls and many birds feed freely upon this mash and are also poisoned. This may also happen if birds feed upon poisoned caterpillars.

Sometimes the army worms crawl up on the stems of grasses, grains, etc., and remain there feeding, so that materials placed on the ground, such as bran mash, do not reach them. In several instances two men with a rope stretched between them, walking across fields where this was the case, would knock off the caterpillars, which would then feed upon the poisoned bait below.

If cranberry bogs are menaced from the sides, filling the ditches quite full of water should prove effective when this is possible. If not, and the worms can enter the bog or are already in it, spraying with arsenate of lead as already directed is probably the best treatment.

Enemies.

There are many enemies of the army worm. Birds feed freely upon it, and during the present season the State Ornithologist, Mr. E. H. Forbush, has collected reports that the "birds seen to feed on the army worms here and in other places were: the chipping sparrow, English field sparrow, song sparrow, robin, flicker, bluebird, blackbird, king bird. We also found the brown thrasher and the towhee apparently feeding on the caterpillars, and people reported the cow bird, cat bird, pheasant, yellow-legs and Upland Plover feeding upon them. Robins appear to be among the most effective of all, and the English sparrows were quite numerous in the browned fields, and were seen time after time feeding on the caterpillar.

The nearly extinct heath hen has increased under protection so that there are hundreds of them now on Marthas Vineyard. They receive food in the infested fields in some numbers, and apparently were feeding on the army worm, but we could not get near enough to be positive of this even with our glasses."

In addition, poultry and toads appear to consider this insect an excellent food, and devour many of the caterpillars.

Numerous insects are also enemies of this pest. Among them are several kinds of Tachina flies, which are sometimes so numerous in the fields when the army worms are abundant as to attract notice by their buzzing. They lay their eggs on the caterpillars, usually just behind the head, where they show as small whitish oval bodies. The maggots which hatch from these eggs burrow into the caterpillars and feed upon them and finally kill them, though not until much if not all of the feeding they will do has been completed. These flies and their eggs have been noticed in a great many cases this season. In addition, several hymenopterous parasites are known and several kinds of beetles feed upon the caterpillars.

OUTBREAKS IN FUTURE.

Various theories as to the causes determining outbreaks of the army worm have been offered, but none are wholly satisfactory. Those places where outbreaks have occurred this season are not liable to have another for a number of years. This seems to be a general rule. Even the generation which would normally appear this fall and feed till time to hibernate is likely to have been reduced by the parasites and other enemies during the summer generation so as to be of no importance or even difficult to find.

What may happen in places where the army worm was not abundant the present year is of much importance. Nothing certain can be said upon this point. It should be noted that 1896 was an army worm year over a large part of the country, and that is also true the present season, reports of the abundance of this insect having been received from as far west as Wisconsin.

In 1894 army worms were very numerous in the Cape Cod region and in parts of Franklin County near the Connecticut River in Massachusetts. No reports of its abundance in the State in 1895 have been noted. May we expect a general outbreak in other portions of the State next summer, or two years from now, thus paralleling the conditions in 1894 and 1896? It is not possible to answer this question now, but it would be well to watch the low meadows and areas near swampy land next June and July for any unusual abundance of caterpillars in the grass lands and rank growth, and if the caterpillars are plenty, kill them by spraying, as already directed, before they consume their food there and start to march to other places.

If 1915 and 1916 go by without any unusual abundance of this insect, it is perhaps probable that any immediate danger of an outbreak is over, and that a period of some years at least is liable to elapse before its reappearance.

Literature.

A few of the more important references to articles on the army worm, particularly with relation to New England, are given below: —

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THE HOME VEGETABLE GARDEN.

ALLEN FRENCH, CONCORD, MASSACHUSETTS.

Home vegetable gardening is in sharp contrast to market gardening. The latter needs, for success, special knowledge, very good soil and easy access to market. The former can be made successful on any farm or in any garden. Not that a weedy, poorly planned, badly fed garden is ever worth keeping, but the man who understands the worth, to his family, of a copious and varied supply of fresh vegetables can easily prove the truth of the claim made in the Farmer's Bulletin bearing the same title as this article: —

> The statement can safely be made that a well-kept garden will yield a return ten or fifteen times greater than would the same area and location if devoted to general farm crops. A half acre devoted to the various kinds of garden crops will easily supply a farm with a hundred dollars' worth of vegetables during the year, while the average return for farm crops is considerably less than a tenth of this amount.

This article proposes to discuss briefly the management of such a garden.

The size of the garden will necessarily vary with the needs of the family. Personal tastes will lead to the inclusion or exclusion of different crops. Some families eat more largely of vegetables than others. Further, some housekeepers have learned with how much ease and satisfaction vegetables may be canned for the winter, and will consequently demand a larger summer supply. It seems safe to say, however, that exclusive of the potato supply, which usually comes from another part of the farm, a half acre is plenty for a large family. Yet if the family goes in largely for asparagus, especially for canning as well as eating fresh, the half acre will have to be considerably added to.

The location of the garden is important. To begin with, it should be permanent, as only thus can it be made, by repeated enrichings, to attain the highest degree of fertility. It should have a southerly exposure (southeasterly is better than southwesterly, but due south is best of all) and should have its rows running south (as thus the plants get the sun on both sides during the day). It should be conveniently near the house for tending and picking, especially since the latter is often done by the women of the family. The garden should also be convenient to the water supply. The question of soil, should there be a choice upon the farm, is also of importance. Any soil can be improved, but the gardener should seek to get a deep medium loam in a location capable of drainage, if that is needed. A slight surface slope is usually sufficient to make drainage unnecessary, provided there is not a clay subsoil.

This study of the soil gives basis for the plan of yearly improvement. If the soil is too light manure will add humus. If the soil is too heavy manure will open it up. If it is not rich enough manure will make it richer; and once enriched manure is needed for maintenance. Therefore — manure ! But in addition to this improvement the soil can be deepened by yearly working up a little of the subsoil, and where drainage is necessary there is only yearly loss by delaying it.

Where enough manure is not to be had the richness of the soil may be maintained by yearly setting aside a part of the garden, — if possible a third, — for the growing of a green crop, preferably a legume, for plowing under. And as autumn approaches, any part of the garden that is cleared for the rest of the season should be planted with a cover crop, such as clover, vetch or rye, for plowing under.

Such individual treatment of small patches means, of course, that the owner recognizes the garden to be the most valuable part of his farm, and accordingly worth the trouble.

Land for the garden is best broken in late fall. It should be plowed, and the sliced earth left on edge for the frosts to penetrate deeply. Perennial roots are more easily killed when their roots are exposed, and the ground is made more mellow for spring working. Further, insect pests are turned out of their winter refuge and are killed. If broken in spring the sod should be turned under deeply. Spring enrichment should consist of manure, as well-rotted as possible, and thoroughly disked in. In an old garden coarse manure should be plowed under in the fall. But rather than plow coarse manure under in the fall with new ground, keep the manure over winter and cure it by frequent turnings.

As a good system of accounts is the best guide to success in farming, the account book should be begun with the first fall working. Labor should be debited in a separate column at current rates, the manure and fertilizer also. Other debit columns should be for seeds, plants, chemical fertilizer and tools. A fair estimate of yearly expenses is not gained, however, especially when starting a garden, unless the tools are entered in an equipment account, only one-fifth of their cost being charged per year, on the theory that any good tool will last for five years, and by that time will have paid for itself. Credit columns will be few, but care should be taken to credit the garden with everything taken from it at current prices.

It is not to be supposed, after breaking the land in the fall, that no more work of gardening is to be done until spring. Indeed, the most important work of the garden is done in the winter, — the planning; for if the soil into which so much money is to go is not cropped to its last available foot there is waste, and this cannot be prevented except by planning. No man can go out to his freshly plowed garden, cast his eye over it, and plant it offhand in the best way. This work should be done on winter evenings, with paper and ruler and pencil, and with seed catalogues at hand. The dimensions of the garden should be exactly known. The best sort of paper for planning is called cross-section paper, ruled in small squares of about an eighth of an inch. With one of these to every foot the garden is easily mapped to an exac stcale. Remember that long rows are the easiest to care for, as there is less turning, and this is an advantage where horse or wheel hoes are used.

On one side of the garden, with rows running north and south, should be put the perennials, asparagus and rhubarb. Forty to 50 good asparagus plants, when bearing well, should produce a bunch a day. Set them 4 feet by 18 inches. Four to 6 rhubarb plants are enough for most families. Set them at the end of the asparagus rows, 4 feet by 4 feet.

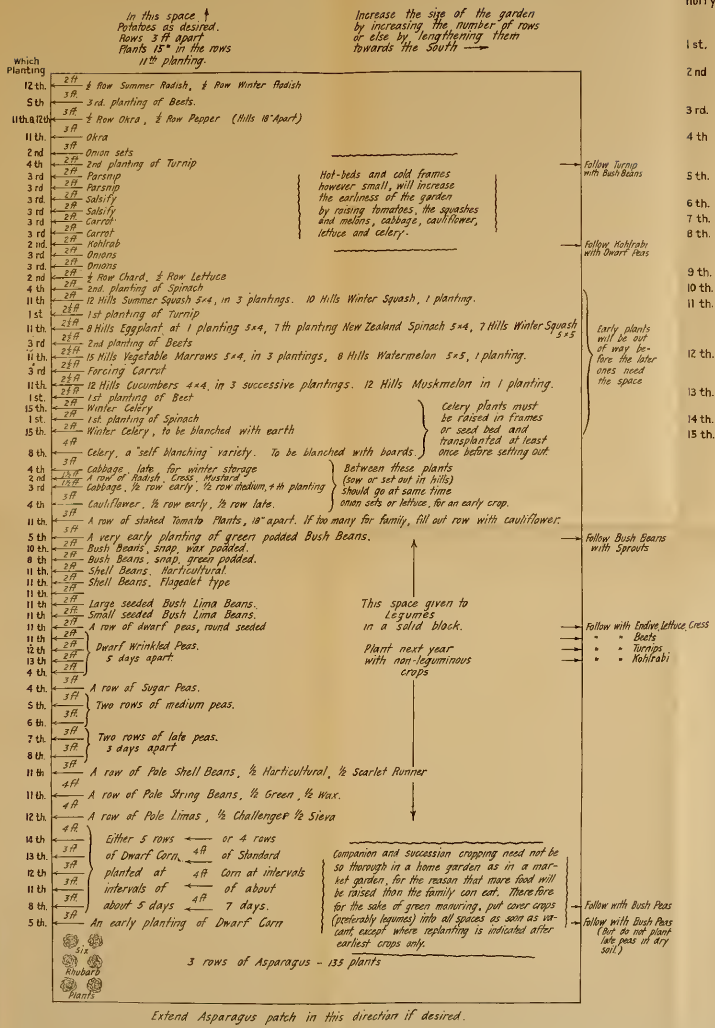
Annual vegetables fall into two kinds of classes: long and short season, and hardy and tender. According to these classifications must the garden be planned, in companion or succession or whole-season planting. Companion cropping means the planting of short-season with long-season crops, the former to be picked before the latter need all the space. Thus lettuce or radish goes between cabbage or staked tomatoes. Succession cropping means the planting of one short-season crop after another, as beans following spinach. It is, on the whole, not wise to put other plants in the same rows with tall-growing plants, such as pole beans or corn, but rows of short-season plants may go between. Squashes and corn, however practical they may be when raised in combination on the farm, do not yield their best when combined in the garden.

This planning should all be carried out to the last detail, so as to keep the garden working at all times. The spacing depends, of course, on whether horse or hand culture is to be used; but in either case the rows should not be too near together for the plants' sake, nor too far apart for the worker's. A list of distances is given below. When finally the plan, probably after several changes, has been finished, it should be carefully inked, or marked clearly with a lead pencil that will not rub.

If the garden is an old one the last-year plan will of course be of use in planning, for even in so small an area as a vegetable garden rotation can be practiced. In this two things may be remembered: first, a crop should not always follow itself, as beans following beans, or tomatoes following tomatoes; second, it is well to keep the leguminous crops together, and to follow them by non-leguminous crops in the next year. The following crop then gets the advantage of the nitrogen left by the legumes.

The plan herewith reproduced is for a fairly large family, and is made according to general tastes. To suit family preferences the gardener will vary the quantities planted. (In my garden, for example, I never plant parsnips or turnips, but I make up for this with marrows, cauliflower and okra.) The distances given on the plan are for hand cultivation, for which some of the rows could be closer. Yet as cultivating in narrow spaces

Vary this prescription according to the taste of the family



In this space ↑
Potatoes as desired.
Rows 3 ft apart
Plants 15" in the rows
11th planting.

Increase the size of the garden by increasing the number of rows or else by lengthening them towards the South ⟶

Which Planting			
12th.	2 ft	½ Row Summer Radish, ½ Row Winter Radish	
5th	3 ft.	3rd. planting of Beets.	
11th.& 12th	3 ft.	½ Row Okra, ½ Row Pepper (Hills 18" Apart)	
11th.	3 ft	Okra	
2nd	3 ft	Onion sets	
4th	2 ft	2nd planting of Turnip	Follow Turnip with Bush Beans
3rd	2 ft	Parsnip	
3rd	2 ft	Parsnip	
3rd.	2 ft	Salsify	
3rd	2 ft	Salsify	
3rd	2 ft.	Carrot	
3rd	2 ft	Carrot	
2nd.	2 ft	Kohlrab	Follow Kohlrabi with Dwarf Peas
3rd	2 ft	Onions	
3rd.	2 ft	Onions	
2nd	2 ft	½ Row Chard. ½ Row Lettuce	
4th	2 ft	2nd. planting of Spinach	
11th	2 ft	12 Hills Summer Squash 5×4, in 3 plantings. 10 Hills Winter Squash, 1 planting.	
1st	2½ ft	1st planting of Turnip	
11th.	2½ ft	8 Hills Eggplant at 1 planting 5×4, 7th planting New Zealand Spinach 5×4, 7 Hills Winter Squash 5×5	
3rd	2½ ft	2nd planting of Beets	
11th.	2½ ft	15 Hills Vegetable Marraws 5×4, in 3 plantings, 8 Hills Watermelon 5×5, 1 planting.	
3rd	2½ ft	Forcing Carrot	
11th.	2½ ft	12 Hills Cucumbers 4×4. in 3 successive plantings. 12 Hills Muskmelon in 1 planting.	
1st.	2½ ft	1st planting of Beet	
15th.	2 ft	Winter Celery	
1st.	2 ft	1st. planting of Spinach	
15th.	2 ft	Winter Celery, to be blanched with earth	
8th.	4 ft	Celery, a "self blanching" variety. To be blanched with boards.	
4th	3 ft	Cabbage, late, for winter storage	
2nd	1½ ft	A row of Radish, Cress, Mustard	
3rd	1½ ft	Cabbage, ½ row early, ½ row medium, 4th planting	
4th	3 ft	Cauliflawer, ½ row early, ½ row late.	
11th.	3 ft	A row of staked Tomato Plants, 18" apart. If too many for family, fill out row with cauliflower.	
5th	3 ft	A very early planting of green podded Bush Beans.	Follow Bush Beans with Sprouts
10th.	2 ft	Bush Beans, snap, wax podded.	
8th	2 ft	Bush Beans, snap, green podded.	
11th.	2 ft	Shell Beans. Harticultural.	
11th.	2 ft	Shell Beans. Flagealet type	
11th.	2 ft		
11th	2 ft	Large seeded Bush Lima Beans.	
11th	2 ft.	Small seeded Bush Lima Beans.	
11th	2 ft	A row of dwarf peas, round seeded	Follow with Endive, Lettuce, Cress
11th	2 ft	Dwarf Wrinkled Peas. 5 days apart.	" " Beets
12th	2 ft		" " Turnips
13th	2 ft		" " Kohlrabi
4th.	2 ft		
4th.	3 ft	A row af Sugar Peas.	
5th.	3 ft	Two rows of medium peas.	
6th.	3 ft.		
7th.	3 ft	Two rows of late peas. 3 days apart	
8th.	3 ft.		
11th	3 ft	A raw of Pole Shell Beans. ½ Harticultural. ½ Scarlet Runner	
11th.	4 ft	A row of Pole String Beans. ½ Green, ½ Wax.	
12th.	4 ft	A row af Pole Limas, ½ Challenger ½ Sieva	
14th	4 ft.	Either 5 rows of Dwarf Corn planted at intervals of about 5 days ⟵ or 4 rows of Standard Corn at intervals of about 7 days. (4 ft)	
13th.	3 ft		
12th	3 ft		
11th	3 ft.		
8th.	3 ft.		Follow with Bush Peas
5th.	3 ft	An early planting of Dwarf Carn	Follow with Bush Peas (But do not plant late peas in dry soil.)

Hot-beds and cold frames however small, will increase the earliness of the garden by raising tomatoes, the squashes and melons, cabbage, cauliflower, lettuce and celery.

Early plants will be out of way before the later ones need the space

Celery plants must be raised in frames or seed bed and transplanted at least once before setting out.

Between these plants (sow or set out in hills) should go at same time onion sets or lettuce, for an early crop.

This space given to Legumes in a solid block.

Plant next year with non-leguminous crops

Companion and succession cropping need not be so thorough in a home garden as in a market garden, for the reason that more food will be raised than the family can eat. There fore for the sake of green manuring, put cover crops (preferably legumes) into all spaces as soon as vacant, except where replanting is indicated after earliest crops only.

3 rows of Asparagus – 135 plants

Extend Asparagus patch in this direction if desired.

PLAN FOR VEGETABLE GARDEN 165 × 100 FEET
THE SAME GENERAL IDEA MAY BE ADAPTED TO A GARDEN OF ANY SIZE

Plantings are according to an average season, beginning about April 10. If the year is backward plant late. Do not hurry planting of whole season crops

Plantings are

1st.	April 10?	Round Peas, Wrinkled Peas Beets, Spinach, Turnips
2nd	3 days	Radish, Mustard, Cress, Peas, Kohlrabi, Onion Sets, Chard, Lettuce.
3rd.	6 days	Beets, Parsnip, Chard, Salsify Onion Sets, Early Cabbage, Peas.
4th	9 days	Turnip, Spinach, Peas, Cauliflower, Summer Cabbage, Lettuce, Onion Sets.
5th.	12 days	Risk a planting of Corn and Bush Beans. Beets.
6th.	15 days	Mid-season Peas.
7th.	18 days	Tall Peas, New Zealand Spinach
8th.	21 days	Last Peas. Set out Cauliflower Cabbage, Lettuce, Onion Sets, 1st. Celery. Sow Corn, Green Beans.
9th.	25 days	Sow Winter Celery Seed
10th.	30 days	Corn, Wax Beans
11th.	35 days	Corn, Shell Beans, Cucumbers, Summer Squash, Marrow, Bush Limas Pole Kidney Beans, Eggplant, Tomato, Potato, Melons, Pepper.
12th.	40 days	Pole Limas, Summer and Winter Radish. Set out: Cucumbers, all Squashes, Melons, Tomatoes, Pepper
13th.	45 days	Corn, 2nd Cucumbers and Marrow, Summer Squash.
14th.	50 days	Corn.
15th.	55 days	Last Corn, Cucumbers, Marrows, Summer Squash. Set Winter Cabbage, Celery and Cauliflower. Sow Last Beets and Turnips.

between seedlings is very delicate work, the 2-foot limit should be maintained if so much space can be afforded. It will be observed that the tall plants (corn and pole beans) are together, to prevent shading smaller plants. The legumes are in a solid block. Companion and succession cropping are planned for as much as seems wise in a home garden; much cover cropping, which means enriching, can be done. The potato patch may be added or not, according to farm or garden conditions. On the margin of the plan a table of approximate planting dates is given.

The beginning of this season of planting varies in Massachusetts from early until late April, according to four conditions. Toward the south, or near the sea, the season is much earlier than near the Vermont hills. The nature of the soil, its texture and drainage, next influences earliness, but is the one factor which can be changed. Exposure (easterliness or westerliness, and the valuable protection given by a windbreak) may make a difference of several days. Finally, the season itself varies considerably from year to year. Distrust an early spring; it may be treacherous. Correspondingly, a backward spring may be kindly. Never be in a hurry to plant the whole-season crops, such as parsnip or late cabbage. With them a few days counts for little.

In studying the garden plan the reader may find names of plants which he has never grown. Yet none of them are merely "fancy." Chard and New Zealand spinach are very dependable summer greens, yet on many of our farms and gardens they are still unknown. Thin chard to 18 inches; plant the spinach in hills 4 or 5 feet apart; both plants may be picked all summer. Kohlrabi is an above-ground turnip; it should be picked young. No garden should grow pumpkins when it can grow squash, except for jack-o'-lanterns. Vegetable marrow is a summer squash which bears very freely and can be cooked in several ways. The small marrows are excellent for canning. As for carrots, no one knows how good they taste until he tries the small forcing varieties. Okra is for gumbo soup. Savoys are more delicate than common cabbage. Endive (do not get the root-crop kind) is a fall lettuce, which to be at its best should be blanched by tying up the heads. Sugar peas, to be treated like string beans, add much to table variety. And finally, every garden should have a few hills of muskmelons and watermelons as delicacies. There is no fear of their crossing with squash or cucumber.

These newer kinds of vegetables add to the interest of the garden, first by giving variety to the table, and next by keeping the gardener awake to the work that plant-breeders are doing for his benefit. The progressive gardener will grow at least one new plant, or a new variety of a well-known plant, every year.

The list of vegetable varieties given at the end of this article is intended as a partial guide for buying, Unfortunately, after a few years such a guide becomes antiquated. But when new it names standard varieties which can be bought of most New England seedsmen. Further, it shows at all times the various classes into which can be divided such plants as beans, corn and radish.

Having finished the plan and decided what varieties shall be used, the next important piece of work is ordering the seeds. Generally speaking, it is safe to calculate from the data given in most seedsmen's catalogues, and from the space to be covered in the garden, the amounts of seed necessary. For example, the catalogue will state that a quart of bush beans will sow 100 feet of drill; and that of pole beans, a quart of limas will plant 100 hills, and of smaller sorts, 200 hills. Knowing how many feet and hills we wish to plant, the quantity to order is readily calculated.

But where shall the seeds be bought? Unless previous testing has proved the local grocer to carry reliable seeds he is usually the last one to depend on. To be sure, his seeds come in an attractive show-case, and in envelopes with gaudy pictures; but on the average these seeds had better be avoided. Buy preferably of a man who makes seed-handling a large part of his business, and whose living, therefore, depends on the excellence of his stock. If there is no such man at hand there are several such in each city who publish excellent catalogues and who can safely be dealt with by parcel post. Your farm journal will name for you some of these men. They usually pay postage on all seeds except the bulky packages of beans, peas and corn. It is insurance to deal with such men.

Seed-catalogues are usually published in January. It is well to order as early as possible, to insure prompt service, and also to make sure that a shortage of stock, which occurs almost yearly in some kind of seed, will not cause disappointment.

Early ordering also gives time for testing any seed of which for any reason the buyer is suspicious. If proved to be of poor vitality it can be replaced.

In the winter all necessary tools should be bought. The beginner at hand culture needs at least a spading fork (be sure to get one with a strap ferule), a hoe and a rake; line, stakes and labels; a trowel; and if not a wheelbarrow, at least a basket. He should have a wheel hoe if he can afford it. If his ground is free from stones, and his garden large, a planting machine will probably pay for itself. For horse culture, besides these tools the gardener will need a cultivator and possibly a seed drill. If he does not wish to buy the plow and harrow he can hire them once a year.

Fertilizer should also be ordered in the winter. When planted in large fields, vegetables properly require a different mixture for each crop; but in the vegetable garden this is not practicable. They are therefore best divided into two classes: those which are used for their stems or leaves, as spinach, chard, lettuce, cabbage; and those which are grown for their seed or root, as beans and peas, potatoes, turnip. The first of these should uniformly be treated with a nitrogenous fertilizer, say a reliable *high-grade* top-dressing; the second should be given a similarly good potato fertilizer. The reason for this difference is of course simply because nitrogen, when given in large proportion, stimulates to top growth instead of to blossom or root growth. But nitrogen, in the form of nitrate of soda or sulphate of ammonia, should always be on hand to give in very small quantities, to struggling young seedlings, or to plants when just set out. It should be given as a top-dressing and washed in with water (manure-water is just as good); the other fertilizers may be given in the same way, or sowed beneath the plants in the drill or hill, to give a good start.

No one will garden for many years in succession without some attempt to lengthen his season by the aid of glass. If the tomato and lettuce plants are started in the south window in boxes, some weeks may be gained in their growth. Flats may be easily made of old tobacco or starch or soap boxes, cutting them down to an inside depth of about 2½ inches. With good medium loam, with care not to water either too little or too much, and with either thinning or transplanting when the plants have four true leaves, good plants may be raised. Cabbage, cauliflower, squash, eggplant and still other plants may thus be raised in considerable numbers in very small space. Cucumber, squash, marrows and melons should be raised in individual holders, such as strawberry baskets, as they transplant poorly.

Equally simple is the aid which can be given to plants in the open garden, to protect from the cold. Small boxes, having neither bottom nor top, can be set over single plants; with a pane of glass to each, removed when the sun is very hot, the boxes become tiny cold-frames. In default of glass, or with boxes too large for the use of single panes, cheesecloth may be used; or this may be tacked over a melon crate or peach basket. This latter kind of protection, which need never be removed until the plants are crowded, is particularly valuable over hills of cucumber or squash or melon, as it keeps away insect pests. Similarly, cabbage or cauliflower plants raised in a small frame over which cheesecloth is tacked cannot be attacked by the maggot until they are ready to transplant.

The step beyond such home-made devices is the attainment of a cold-frame. One may be made to fit such old sash as may be at hand; or it may be bought for the standard 3 by 6 foot sash. These sashes, with overlapping panes to shed water, may be bought in all quantities; but it will pay to have them of cypress, strongly put together. Double-glassed sashes are becoming popular. A four-sash frame, partitioned into two sections, for hardy and for tender plants, will provide early plants for a garden of considerable size, and ought to be enough for a large family.

The management of a cold-frame is very simple. The seed is sown in rows 3 to 6 inches apart, and the plants are thinned, watered and transplanted until large enough to set out in the garden. Care must be given to ventilation in frosty weather, both to keep the plants from burning in the sun and to keep them from freezing at night. Mats and shutters are needed to keep out heavy frosts.

A hotbed is only a cold-frame, under which hot manure is placed to keep the ground warm. It needs extra care, first to bring the heating manure to the right temperature, and next to keep the seedlings from damping off in too moist an atmosphere.

In Massachusetts the hot bed may be started late in February, the cold-frame a month later.

As spring approaches, work in the open garden begins. Nothing can be done until the frost is out of the ground, but even then the soil, unless light and well-drained, may be too wet to handle for several days more. Then the plowed ground may be smoothed by the harrow or by the hoe and rake; or in case the garden is to be manured the dressing may be disked or spaded in. In hand work it is well to get out all stones larger than a hen's egg, — tedious work in ground where more work up each year, yet in the long run sure to pay, — and also all roots of such perennials as witch grass. When the surface is smooth, planting may begin.

In planting the nature of the different plants must be accommodated to the stages of the season. Certain plants are hardy to light frosts: such are beets, cabbage, Brussells sprouts, cauliflower, celery, carrot, chard, cress, endive, kale, kohlrabi, leek, lettuce, parsley, parsnip, pea, radish, salsify, spinach, turnip. Other plants are easily injured or killed by frost: such are beans, corn, cucumber, eggplant, muskmelon, okra, pepper, squash, tomato, watermelon. So long as frosts are likely, therefore, say until the middle of May, it is safe to sow only hardy plants. Yet it is often safe to risk an early planting or two of corn and beans. As the danger of frosts lessens, the tender plants may be sowed. Since potatoes are tender, they should seldom be set out before the middle of May.

Planting distances should be such, both in and between the rows, that the plants will not crowd. Crowding means stunting, and stunted plants cannot yield a proper crop. As already noticed, for convenience in cultivating a garden of any size, where the work must be done rapidly, and usually with a wheel hoe, it is not wise to have the rows much less than 2 feet apart. Nevertheless, where space is limited, and where the gardener is prepared to work delicately, rows of small plants such as radish, forcing carrot, cress and lettuce may be as close as 9 inches; and larger plants such as salsify, carrot, bush beans and peas may be 18 or 20 inches apart. In such a garden rows of dwarf corn may stand 2 feet apart, with single plants a foot apart in the row; pole beans may be in hills 30 inches apart each way; and cucumber need be scarcely wider spaced. Nevertheless, since on the farm there is seldom need of such intensive cultivation, the following spacing will be more convenient to follow.

The spaces are for hand culture. For horse cultivation the narrowest alleys should be widened to at least 30 inches. Where rows of a larger and a smaller plant stand side by side give the larger space or "split the difference." (In the table, ′ stands for feet and ″ for inches.)

- Asparagus, 4′ x 18″.
- Beans: —
  - Bush, 2′ x 1′.
  - Pole, 4′ x 4′.
- Beet, 2′ x 4″.
- Brussells sprouts: —
  - Dwarf, 2′ x 1′.
  - Standard, 2′ x 2′.
- Cabbage: —
  - Early, 2′ x 2′.
  - Late, 3′ x 2′.
- Carrot: —
  - Early, 2′ x 9″.
  - Late, 2′ x 15″.
- Cauliflower: —
  - Early, 2′ x 2′.
  - Late, 3′ x 2′.
- Celery: —
  - For blanching with boards, 2′ x 9″.
  - For earthing, 4′ x 9″ (or set in double rows 1′ apart, the plants 9″ or more apart in the rows, in alternate spaces; 4′ between the double rows).
- Chard, 2′ x 18″.
- Corn: —
  - Early: hills 30″ x 30″ (or rows 30″ apart, plants 1′ apart).
  - Later: hills 4′ x 4″.
- Cress, rows 2′. Do not thin.
- Cucumber, 4′ x 4′.
- Eggplant, 4′ x 4′.
- Endive, 2′ x 1′.
- Kale: —
  - Dwarf, 2′ x 1′.
  - Standard, 2′ x 18″.
- Kohlrabi, 2′ x 9″.
- Lettuce, 2′ x 9″–12″.
- Muskmelon, 4′ x 4′ or more.
- Mustard, 2′. Do not thin.
- Okra, 2′ x 18″.
- Onion, 2′ x 6″–9″.
- Parsley, 2′ x 18″.
- Parsnip, 2′ x 18″.
- Peas: —
  - Bush, 2′ x 2″.
  - Tall, 3′ x 2″.
  - (Plant peas in rows 6″–9″ apart; dwarf peas support each other; for tall peas, put the wire between.)

- Pepper, 2′ x 2′.
- Potato, 2′ x 14″.
- Radish: —
  - Spring and fall kinds, 2′ x 3″.
  - Summer, 2′ x 1′.
  - Winter, 2′ x 2′.
- Rhubarb, at least 4′ x 4′.
- Salsify, 2′ x 12″–15″.
- Spinach, 2′ x 9″–12″.
  - New Zealand, hills 4′ x 4′.
- Squash: —
  - Summer, 4′ x 4′.
  - Vegetable Marrow, 4′ x 4′.
  - Winter, 5′ x 5′.
- Tomato: —
  - Staked, 2′ x 18″ (to be pruned).
  - On frames, 2′ x 2′.
  - Sprawling, 3′ x 2′.
- Turnip, 2′ x 9″–12″.
- Watermelon, 5′ x 5′.

The depth of planting varies somewhat with circumstances. The rule for planting in flats is to cover a seed to twice its thickness; but outdoors this can scarcely be followed, first because such delicate work is impossible, and second because soils vary. In a light soil, where there is danger of the seed's drying out, the planting may be twice as deep as in a moist soil. Small seeds in dry soil should be at least a quarter inch deep, but celery seed, which should always be planted in a seedbed, should be merely pressed into the moist earth; and, on the other hand, peas should go quite deep. It is well to plant peas in shallow trenches of about 6 inches depth, to cover lightly, and when the plants are growing to fill in the trenches in cultivating. This will insure deep rooting and plenty of moisture. After planting any seed, and firming the earth over it, scatter a light mulch of earth over the place, to prevent drying or baking.

After planting there is necessarily a time of waiting for the seedlings to appear. If weeds sprout, or if a rain comes and packs the surface, so that it bakes or dries out in the sun, the gardener will be anxious to cultivate. This will be dangerous unless the rows have been properly marked, and even then the work is delicate. But just as soon as the seedlings appear the work of cultivation should begin, and should be repeated as soon as weeds are numerous, and after every shower; for cultivation not merely kills the weeds, — it saves the moisture in the garden by coating the soil with an inch or two of dust, through which the water cannot evaporate. Properly cultivated, a garden will need little watering, even in a drought. But cultivation should be thorough.

Most modern gardeners are abandoning the hilling of corn and potatoes. Hilling injures the plants by cutting off the upper feeding roots. It also makes in the garden a greater surface for evaporation.

Thinning should begin early, as soon as the seedlings have four true leaves, and before they crowd, except as noted below. And as it is important that the plants should not injure each other, the gardener should have no mercy on the extra plants. But there are exceptions. Mustard and cress should not be thinned at all. Chard and beets and spinach, after first thinning to an inch or two, may be left to grow larger and to be thinned again from time to time, the thinnings to be eaten as greens.

The work of transplanting is made safe by a little care. Choose, if possible, a cloudy day, or work in the afternoon. Water the plants thoroughly half an hour before lifting. The ground to receive the plants should be moist. Dig the hole for each plant a little too deep, scatter in the bottom compost or well-rotted manure, with a little fertilizer, and cover lightly with earth; then fill the holes once with water. Lift the plants singly, with much earth, if that is possible, and set immediately; at any rate, keep them from the sun when once they are dug, and prevent the roots from drying out. Cut off half the leaf-surface, to equalize the loss of roots. Water the plants; and if the sun is hot, shade them, also, for the rest of the day and the hottest part of the next. Old strawberry boxes are excellent for shading small plants.

The work of gardening naturally changes with the season. As the summer advances, and the plants spread, the work of cultivating gradually lessens and that of picking begins. Here the average gardener makes the mistake of letting the crop grow too old. Beans grow stringy, peas tough, summer squash coarse. Nothing is gained by this, for plants from which the fruit is taken early make up by yielding more. It is much wiser to take the crop when it is young and tender. Okra and kohlrabi are ruined if not picked when young.

It is here that the proper management of a garden comes in. To know at just what stage each crop is, and to pick it when at its best, requires a little forethought. But garden management goes further than this. Staked tomatoes should weekly be pruned (one to three stalks) and tied. The watching of the crops leads to proper succession planting. The moment a row of plants has finished its usefulness it should be dug up, and no time should be lost in planting its successor. Thus early spinach is followed by cauliflower from the frames, or peas are succeeded by beets. As the summer advances it will be too late to follow with vegetables; but the cover crops should go in as promptly as possible, to get a good growth before winter. Garden management includes, further, a careful lookout for the coming of insect pests. Otherwise the squash bug or the cabbage maggot will do irreparable damage.

As soon as there is a sign of them, therefore, the campaign against them should begin. There is no space here to tell what to do in each case, nor how to take preventive measures against diseases. (Diseases can never be cured; the only salvation is prevention.) The reader should, for help in such cases, consult Circular No. 2, Massachusetts State Board of Agriculture, "Insecticides, Fungicides and Directions for their Use."

Neatness in the garden is worth while not only for itself, but for its results. All rubbish should be gathered daily, and piled in some out of the way place. The resulting heap is called the compost heap, and if the garden waste is not given to the pigs or chickens, it yet can do good service by turning itself into the best of earth mold, valuable in providing earth for the flats, or for enriching the hills of squash and melons. Compost is quite as valuable as manure.

The saving of seed is often possible in the garden. If the gardener is sure that there has been no crossing, and likes his strain of corn or squash or tomato, he cannot merely save himself a little money, but can by careful selection, even improve his seed.

From late summer onward the garden would begin to look bare were it not for cover crops. These, as already mentioned, should be sowed in every space as soon as it is vacant. In summer crimson clover is the best to use; as frosts approach, winter vetch will be better; and after frosts begin rye is best used for a quick result. When turned under, these will provide plant food.

The coming of frosts challenges the gardener to protect his plants. The tall plants, such as corn, must meet their fate; but the low-growing can often be saved by the use of old cloths, burlaps or bedding hay. Tomatoes (staked tomatoes may be laid down), squash and cucumbers can thus often be saved for weeks. But at last even the cabbages must be taken up, if they are to be saved, or if they are in the way of the final preparation of the garden for the winter.

This should consist, if the gardener can possibly afford it, of the plowing under of manure. Cover crops, if large, may be plowed under also; or else, if they are small, or if the slope of the garden renders it liable to winter washing, they may be left for surface protection until spring.

Roughly, then, this reviews the work of vegetable gardening. The city man regards it as a desirable pastime; but the average farmer is still but too likely to resent it as an encroachment upon his time. He fails to realize the money value of his crop; fails also to perceive the aid to health which he and his family gain from food which not even the richest magnate can improve upon.

List of Vegetable Varieties.

Asparagus: Argenteuil, Palmetto, Reading Grant (if buying roots, get only one-year).

Beans (Bush): —
  Snap (Green): Stringless Green Pod, Valentine, Refugee.
  Snap (Wax): Kidney Wax, Golden Wax, Currie's Rust Proof.
  Shell: Horticultural, Green-seeded Flageolet.
  Lima: Burpee's Bush, Henderson's Bush, Fordhook Bush.
Beans (Pole): —
  Snap (Green): Kentucky Wonder.
  Snap (Wax): Golden Cluster.
  Shell: Golden Carmine, Scarlet Runner.
  Lima: Challenger, Carpinteria, Sieva.
Beet: Crosby's Egyptian, Edmands'.
Brussels Sprouts: Aigburth (Standard), Dwarf French.
Cabbage: —
  Early: Early Jersey Wakefield, Copenhagen, Early Vienna Savoy.
  Late: Danish Ballhead, Flat Dutch, Green Globe Savoy, Red Dutch, Red Rock.

Carrot: —
  Early: Parisian forcing.
  Medium: Chantenay.
  Late: Danvers Half Long.
Cauliflower (get the best seed!): —
  Early: Early Snowball, Early Erfurt.
  Late: Autumn Giant.
Celery: Golden Self-Blanching, Boston Market, Giant Paschal.
Chard: Lucullus.
Corn: —
  Early: Peep o' Day (white). Golden Bantam (yellow).
  Medium: Crosby.
  Late: Evergreen, Country Gentleman.
Cress: Curled, or Peppergrass.
Cucumber: White Spine, Russian (short).
Eggplant: Black Beauty, New York Improved.
Endive: Winter Curled, Escarolle (do not get the root plant, chicory).
Kale: Dwarf Green Curled, Winter (or German Greens).
Kohlrabi: White Vienna, Purple Vienna.
Lettuce: —
  Heading: May King, Tennisball (black-seeded), Big Boston, Mammoth Black-seeded Butter.
  Curled: Hanson, Simpson. Grand Rapids.
  Cos or Romaine: Express, Trianon.
Muskmelon: —
  Green or yellow flesh: Long Island Beauty, Rocky Ford.
  Red Flesh: Emerald Gem, Fordhook, Honey-drop.
Mustard: White.
Okra: Dwarf Green.
Onion: —
  Sets: White, Yellow and Red.
  Seed: Yellow: Danvers, Ailsa Craig, Prizetaker.
  Seed: White: Silver King, Portugal.
  Seed: Red: Globe, Wethersfield.
Parsley: Moss Curled, Dobbie's Curled.
Parsnip: Early Round, Hollow Crown.
Peas (varieties given are wrinkled only): —
  Early: American Wonder, Gradus, Sutton's Excelsior.
  Medium: Alderman, Advancer, Dwarf Telephone.
  Late: Telephone, Stratagem.
  Sugar: Mammoth melting.
Pepper: Large Bell, Ruby King, Upright Sweet Salad.
Radish: —
  Spring and fall: French Breakfast, Icicle.
  Summer: Strasburg, Stuttgart.
  Winter: Sakirajima, Spanish.

Rhubarb: Victoria, Linnæus (buy roots. Rhubarb does not come true from seed.)

Salsify: Mammoth Sandwich Island.

Spinach: —

Long Standing, Round Thick Leaved, Prickly Seeded (for fall sowing).
New Zealand Spinach (to be cropped all summer).

Squash: —

Summer: Summer Crookneck, Mammoth White Bush (pattypan).
Vegetable Marrow: English, Italian (Cocozell).
Winter: Delicious, Hubbard.

Tomato: Dwarf Champion, Dwarf Stone, Livingstone's Stone, Stirling Castle (medium size), Ponderosa (very large).

Turnip: Snowball, Cowhorn (long white), Yellow Stone.

Watermelon: Halbert Honey, Early Fordhook, Cole's Early.

Potato: —

Early: Irish Cobbler, Early Rose.
Medium and late: Green Mountain, Beauty of Hebron.

THE SANITARY SIDE OF FARM WATER SUPPLIES.

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The methods of obtaining water supplies for the farm in Massachusetts differ considerably from place to place, with the varying conditions of topography and soil. In the hilly regions in the central parts of the State, and in the mountains west of the Connecticut River, the farm water supply is obtained in many cases from springs located on a hillside at a higher level than the farm buildings, and the water is consequently supplied by gravity, giving running water in house and barn. In the sandy regions of Cape Cod and the southeastern parts of the State water supplies are commonly obtained from tubular wells driven in the porous soil. These wells are usually wrought-iron pipes having a diameter sometimes as small as 1 inch and sometimes as great as 8 inches, but usually a diameter of 2 or 2½ inches is preferred. In some cases water is taken from brooks, ponds or running streams, but the number of such supplies is small.

By far the greater number of farm water supplies in Massachusetts outside the limits of town or village water works systems are obtained from ordinary wells dug in the ground and curbed commonly with field stone, the usual diameter being 3 to 4 feet. The number of wells and springs used for the water supplies of farms and village homes in Massachusetts is undoubtedly very large, notwithstanding the fact that 95 per cent. of the inhabitants of the State live in cities and towns which are provided with public water supplies. In the cities and the larger towns the public supply is available to practically all of the inhabitants, but in the smaller towns only the villages and thickly settled areas are supplied by public works as yet, and there is consequently a considerable number of inhabitants in the cities and towns which are provided with public water supplies who must depend on their private sources.

The total population living in towns in which there is no general supply was, in 1912, about 170,000. There are probably 50,000 people having private water supplies who live in towns in which a portion of the inhabitants are supplied from public works. Allowing five persons to a family, there are probably more than 40,000 families in the State who maintain private water supplies, and, assuming that there is an average of one such source of supply to each family, there are 40,000 or more private water supplies in use on the farms and in the villages in Massachusetts.

Massachusetts has long been settled, and there has been comparatively little division of farms in many years. Undoubtedly a large percentage of the farm wells now in use were constructed many years ago, and have been in use continuously for a very long time, in some cases, no doubt, for much more than half a century. In earlier times little or nothing was thought of the danger of the pollution of the water supply from the wastes of human life except from possible pollution discharged directly into the well, and a well water that was clear, colorless and free from taste and odor was regarded as wholly satisfactory.

The well from which water was to be taken for household use was commonly located as close as practicable to the farm buildings, especially the dwelling house, for convenience in obtaining water for household use. The water was drawn commonly with a bucket and later with a pump, and at many of the farm and village dwellings the household well was for convenience located in the cellar of the house, or even in a corner of the barn. The household sewage is also commonly disposed of in the immediate neighborhood of the house, and at the older places the privy, cesspool and sink drain, and the barn with its manure pile, are often found located at no great distance from the well.

The question is often asked why old wells which have apparently yielded, and probably did yield, good water many years ago do not furnish water of the same quality to-day; and it is often difficult for dwellers in a village or on well-kept farms to understand why a well which has apparently yielded good water for many years does not supply good water to-day. The answer in many cases is that when the well was first dug the buildings which it was designed to supply had only just been constructed, and little or no sewage had ever been deposited upon the ground in the region about the well. As soon as the premises were occupied the seepage from the privy, sink drain and cesspool, which were commonly located at no great distance from the well, began percolating into the ground in its neighborhood. The drawing of water from a well naturally draws the ground water at that point to a lower level than elsewhere in the neighborhood, and induces a flow of water through the ground in its direction, and where sewage is discharged upon or into the ground in the region influenced by the draft of water from the well, seepage therefrom would naturally have a tendency to flow toward the well.

It is probable that in the beginning, and perhaps for many years, polluted matter from privies, cesspools, etc., thus percolating through the ground was thoroughly purified by oxidation and nitrification in its passage through the soil before reaching the well, just as the sewage of villages and towns is now purified by passing it slowly and intermittently through sand filter beds; but after a long period of continuous passage of water containing organic matter through the ground with air constantly excluded, the efficiency of the purification becomes less and the effect of the pollution upon the ground water more serious. It is also probable that the finer matters in the soil are gradually washed out, and the passage of the water through the ground thus allowed to become more rapid.

The indications are that polluting matter from a privy or cesspool percolating toward a well does not spread out over a very large section of soil, but where the soil is fairly homogeneous is confined to a section of about the same area as that of the privy or cesspool from which it comes. It is sometimes practicable to determine quite definitely the area affected by seepage from a privy or cesspool when excavations are made at a point where such receptacles for sewage have been located. An example of this was once seen by the writer, where a reservoir, upon one shore of which were located several privies and cesspools, was drawn down, exposing a steep slope from which the surface soil had been removed when the reservoir was built. In this case the indications of the areas through which the liquid percolating from the privies and cesspools to the reservoir was passing were very clearly marked by the iron rust which settled out of the water on its coming to the air at the bank of the reservoir, and the traces of percolation from these eight or ten receptacles were in each case very clearly marked. In these cases it was evident that the path of the polluted water was quite direct, and that the area of cross section through which it passed was but little greater in any of these cases than the area of the privy or cesspool itself. The path of the waste had evidently remained the same for many years, indicating that the passage of the polluted liquid did not have a tendency to clog up the ground, but that rather the ground offered less resistance to the passage of the polluted water as time went on. The soil in this case was but slightly porous, being what is sometimes called a gravelly hardpan.

The rate of percolation of water through the soil varies greatly with the character and porosity of the material, and liquid percolating from a cesspool toward a well may require a long time in its passage through the ground before it materially affects the character of the water of the well, but where the soil is porous sand or gravel, and much water is drawn from the well, percolation may be rapid.

Under the general geological conditions in Massachusetts, the water which enters a well is derived from the rainfall which falls upon the ground immediately about it and percolates through the ground to the well. The area from which ground water is influenced to flow toward a well depends upon the porosity of the soil, the quantity of water drawn, and the general trend of the ground water of the locality in which the well is situated. The area from which a well derives its supply cannot always be determined very definitely, but it can usually be determined with sufficient accuracy for practical purposes.

An average family of six persons would ordinarily use — with the water required for animals, etc., and allowing a small amount for irrigation of gardens about the house in the summer season — about 600 gallons per day. Assuming an average rainfall of 42 inches per year, about 8,500 square feet of land would be required to collect from the average rainfall the quantity of water used by the family. This would mean a circular space of ground 104 feet in diameter; but, inasmuch as a large part of the rainfall runs off of the ground as it falls, the amount that a well is capable of yielding practically never equals the amount of the rainfall.

An average of one-third of the rainfall on the drainage area of a well is a very large yield, and the quantity is usually much less. Assuming that one-fifth of the rainfall is collectible in a well, the area of ground required for securing a supply of 600 gallons daily would be a space 230 feet in diameter; that is, a privy or cesspool located within 115 feet of a well which derives its water equally from all directions would be likely to drain toward it, even if the rainfall were distributed in equal daily quantities throughout the year.

Of course, the yield of rainfall varies, the amount being large in the winter and spring and small in the summer and autumn, so that in the drier portion of the year water would probably be influenced to flow toward the well from a considerably greater distance than 115 feet.

The foregoing figures refer only to average conditions where the soil is of the same porosity and character over a considerable area. As the character of the soil usually varies considerably, even in short distances, the flow of ground water is probably not usually the same from all directions about a well. There is also likely to be a variation in the flow of water toward a well due to the slope of the ground water, so that pollutions discharged into the ground may be carried to the well from a much greater distance on the side of the well from which the ground water flows most freely than pollutions deposited in other directions about the well.

The surest way of securing a supply of water that is safe for drinking from a well dug near a farmhouse is to so locate the well and the places of disposal for sewage, viz., sink drain, cesspool, privy, barn, etc., that drainage from any of these will not affect the well. The best plan is, of course, to locate the sink drain, cesspool, privy and barn at a lower level than the well, but obviously this can be done only in comparatively few cases where it is desired to locate the well in the immediate neighborhood of the house. Where it is impracticable to dispose of the household sewage at a lower level than the water in the well it is important to locate the places of sewage disposal as far as practicable from the source of water supply. If the soil is sand or gravel and fairly homogeneous a distance of 250 feet will probably be adequate, provided, of course, that the sewage disposal receptacles are not placed in a locality from which the ground water drains most readily toward the well.

It is usually not very difficult to determine the probable trend of the ground water and to take advantage of it in locating the well in such a way that, under the conditions mentioned, drainage from the sewage disposal places is unlikely to affect it.

Where the buildings are located on sloping ground, draining toward a stream or pond, and the well is on the upper side of the buildings and the sewage receptacles on the lower side, the latter may be located at a lesser distance from the well without affecting the quality of the water than where the ground is more nearly level; but it is not advisable, unless expert examination shall show otherwise, to locate a receptacle for sewage nearer than 250 feet from a well unless, of course, the sewage is discharged at a lower level than the water in the well.

It sometimes happens that in order to dispose of the sewage effectively and satisfactorily it is necessary to convey it in a pipe for a considerable distance, and the pipe line may perhaps have to pass near the well or through the soil draining toward the well. In such cases it is always best to construct the pipe of iron with tight lead joints throughout the section likely to be affected by drawing water from the well. In order to make sure that the pipe is tight it should be carefully laid, the joints made tight and tested by filling the pipe with water under considerable pressure before the trench is filled in.

Covering of a Well.

While the most important requirement in maintaining a good well water supply on a farm is to so dispose of the sewage that it will not affect the water, it is also important that the well be carefully covered so as to prevent the entrance of surface water and prevent animals or objectionable matter from falling into it.

The best protection — and usually sufficient — for a well is to lay the upper 5 feet of the stone curbing in cement mortar, carrying the curbing to a few inches above the level of the ground, so that surface water will be diverted from the well and cannot enter it at the top. A cover should be placed over the well or upon sills of joist set in cement on top of the curb. A small box or pipe rising above the platform and with an opening in its sides will provide sufficient ventilation, but it is important that the opening should be screened with fine wire.

If water is drawn from the well by a pump passing up through the platform it is highly important that the platform be made absolutely tight and so sloped that water falling upon it will be carried away from the well. One of the most serious dangers of pollution of a well is water washing from dirty boots upon the platform.

Effect of Lead Pipe.

If the water is drawn through a pump and a suction pipe placed in the well it is best to avoid the use of lead pipe, since many ground waters act rapidly upon lead and cause lead poisoning. A pipe of block tin or of lead lined with tin, provided the pipe is made wholly of tin or of some suitable material where it is in contact with the water in the well, will be safe for use. Pipes of iron lined with tin, or especially with cement, are also satisfactory for conveying drinking water. Galvanized iron pipes are usually satisfactory, but waters which attack lead usually attack iron and, by taking up an excess of iron, make the water objectionable for many domestic purposes.

One other matter should be mentioned, and that is the importance of avoiding the heavy manuring of land in the immediate neighborhood of a well. This practice has been known to affect the water of many wells otherwise good, and it should be carefully avoided for a space of 100 feet or more from the well, especially on the side from which it derives its supply.

It is not practicable within the limits of this paper to go into the question of well-water analysis except in the most general way. Ordinarily, it is impossible to tell from the appearance, taste and odor of a well water whether it is safe for drinking or not. A clarified sewage in an ordinary glass may be clear and colorless and may have no very marked odor and is often not to be distinguished from spring water. The senses are wholly unreliable when it comes to deciding whether a water of good appearance and free from taste and odor is safe for drinking or not. On the other hand, if a well water which has usually been satisfactory becomes suddenly objectionable to taste and smell its use should be discontinued until an examination has been made.

Unpolluted waters are not usually affected by objectionable tastes and odors, though even to this rule there are exceptions, since quite often waters derived from hardpan soils have at times a noticeable taste and odor, even though analysis shows that the water is not polluted or otherwise objectionable for domestic use.

The sudden appearance of turbidity or color in a water which has always apparently been clear and colorless is also good cause for suspicion of the quality of the water even though it is free from taste and odor, and a water which becomes suddenly turbid or colored should not be used until its safety has been ascertained.

If the well is so located that there is no danger of pollution from sewage or other objectionable matter, slight changes in the quality of the water need cause no serious alarm. There are undoubtedly a great many cases in this State where a farm well is not located in such a way that its water can be used with safety for drinking, and in such cases a new supply is a necessity.

As to the best method of obtaining a new supply, it is impracticable to lay down any definite rules, since circumstances vary so widely from place to place that a rule by which a good well might be secured in one place would not produce satisfactory results in the next.

In the sandy and gravelly regions — found mostly in the southeastern parts of the State, but to a considerable extent in the river valleys of the central and western portions — it is usually not difficult to secure ground water in large quantity by sinking a well in low ground at almost any point, provided it is sufficiently distant from possible sources of pollution; but wells sunk in the immediate neighborhood of swamps will ordinarily not supply good water, and it is generally best in swampy regions to locate the well on the upland 50 to 100 feet from the swamp, if practicable. The conditions in some cases are such, however, that waters can be taken from the edge of a swamp or even from beneath its surface and good water secured.

SEWAGE DISPOSAL IN RURAL DISTRICTS.[1]

EDWARD H. WILLIAMS, ROCKLAND, MASSACHUSETTS.

The message I bring this afternoon, it seems to me, is perhaps the most important one of the day.

We have been talking of better farms and better farming, and of the enormous crops that are being raised and which we hope will increase prosperity and lessen the cost of living.

Now if we are to have good crops we must have good farmers, and to be a good farmer one must of necessity be a healthy farmer; and if rural life is to be what it ought to be we must first of all look out for the health of the people living in the rural districts.

It is customary nowadays to speak of units in life and in business, particularly in the manufacturing and heat and power lines. I think that if we divide life into units we should consider the health unit as unit number 1. We must have health if we are to succeed in life and do anything well.

Let us consider some of the most important things that influence our health. Probably no one thing is more important to our well-being than a bountiful supply of good water, both for drinking and general domestic purposes. While a few, comparatively speaking, of our farmers procure their water from a well-protected public water supply, by far the greater portion must obtain their supply from springs or wells, and I am sorry to say that these latter do not always yield pure water. Roughly speaking, there are between 30,000 and 40,000 wells in this State that are in daily use, and, ridiculous as it may seem, there are only about 5 to 10 per cent of them that are unpolluted. Examination and analysis show these things in a much different way from that in which we generally consider them.

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[1] Address delivered before the field meeting of the Massachusetts State grange at South Framingham, August 19, 1914.

I do not mean to say that these wells that are not yielding a supply of pure water are all in an extremely bad condition, for such is not a fact, but they are more or less contaminated, some severely and some only slightly, and any well that shows pollution to any extent must be closely watched and studied to find out the cause. There are a number of ways by which the water in a well or spring can be contaminated, and probably the most common way is by the well being so situated that it receives the wash from the surrounding slopes which runs over the surface and into the top of the well, particularly during and after heavy showers and in the springtime when the snow is melting. Another and very serious way in which pollution of the worst kind may reach the water in wells and springs is by a closely located cesspool or privy of poor construction constantly discharging their contents into the surrounding ground. After a time the ground becomes saturated, and the area saturated increases until it has spread out for great distances in many cases. In very porous subsoils, or perhaps along the surface of or through the fissures in underground ledges, it is hard to estimate how far sewage may travel, but certainly for hundreds of feet in some cases.

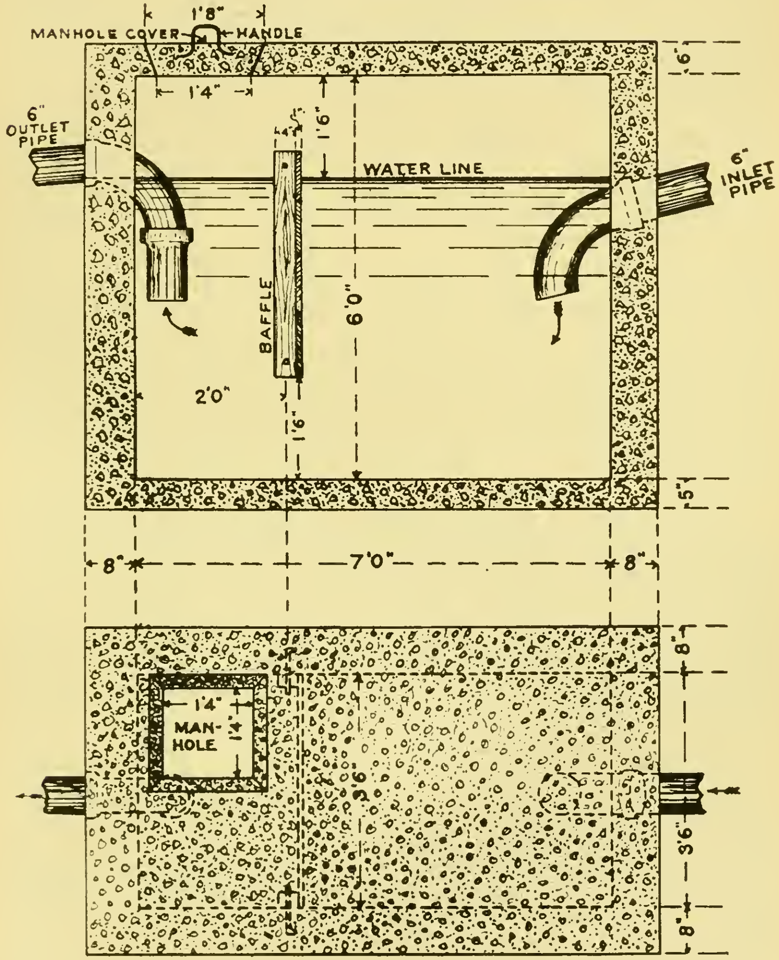
People sometimes ask why a well does not or should not continue to give a good pure supply of water when it always used to, and I would say that it is because of this saturation of the soil, which in some cases may take years before it reaches the water supply, and also because the contamination is not always perceptible to the eye, nose or mouth, and only an analysis can show whether or not a well is polluted and to what extent. You see the trouble lies largely in the fact that germs of disease are invisible, and you cannot tell by looking at water whether or not they are present. By all means have an analysis made of any water that you use for domestic purposes as soon as you detect any taste or odor to it.

One of the worst diseases that we have to contend with is typhoid fever, and while the State health authorities have made a wonderful reduction in the numbers of cases and deaths in this State, it is still far too common. Typhoid fever is frequently contracted by using water from a well or spring that is polluted by sewage. Now typhoid germs will not live in well water very long, but if you have an underground connection between the well and your cesspool or privy you can keep up a constant supply of able-bodied typhoid germs in your drinking water and contract the disease. You know there are people who are known as typhoid carriers, that is, people who may continue to expel the germs from their systems for years after having recovered from an attack of the disease, and one of these carriers might come to your house and leave the germs to do their deadly work. So you see we must dispose of the sewage in some way so that it cannot reach the water supply.

The purpose of this little talk of mine is to tell those of you who are interested how the sewage may be disposed of in a very satisfactory manner in a large number of cases, but not in all cases, for this plan has its limits.

It is not designed for use in cities or towns where there is a sewerage system, or where the premises are so limited that you cannot construct the plant properly, or where there is danger of ridding yourselves of a nuisance only to pass it on to your neighbor. This system is what I call a farm sewage disposal tank, but it has several names, and is constructed as you see on the sketch. It is constructed of concrete and is made light and air-tight, as the successful working of the tank depends on the action of what are called anærobic bacteria, that work best when kept dark and quiet and with little oxygen. The bacteria do their work by consuming the solids, except the mineral matter, and converting them into water which is disposed of in one of the ways that we are to speak of.

The successful working of the tank also depends on a considerable quantity of water passing through it for flushing; and because it will handle a large quantity of water, it makes possible the installation of bathtubs, flush closets, laundry tubs and all of the modern plumbing conveniences that should be placed in every house in the rural districts just as they are in the city houses. These conveniences properly installed add so much to the health and convenience of rural life that their value is beyond estimation. Running water is necessary, of course, to operate the closets, baths, etc., and can be obtained in different ways. Where one has a supply of running water from a spring on a hill that is well protected from pollution he has what I consider an ideal supply. If you have not this kind of a supply you can have running water in your buildings by using a gasoline or hot-air engine, electric motor, windmill or a pneumatic tank to keep your supply tank filled.


1'8"
MANHOLE COVER
HANDLE
1'4"
6" OUTLET PIPE
4"
1'6"
WATER LINE
6" INLET PIPE
6"
BAFFLE
6'0"
2'0"
1'6"
5"
8"
7'0"
8"
1'4"
MAN-HOLE
8"
3'6"
8"

Sewage Disposal Tank
FOR
Rural Residences

Scale ½" = 1'.

THE SEWAGE TANK.

The tank in the sketch is of sufficient size to take care of any ordinary farm home sewage, and is 7 feet long, 3½ feet wide and 6 feet deep, these being inside dimensions; the side walls should be made 8 inches thick, the bottom 5 inches and the top 6 inches thick. If the tank is placed under a lawn or grassland where there is no heavy teaming over it, it will not need any reinforcing, but if placed beneath a driveway the top only should be reinforced. The manhole cover should be placed in one corner so as to enable you to remove the lumber you use for concrete forms without cutting it. The tank should be placed so that it is covered with at least 18 inches of soil, and then it will never freeze up. It must also be placed in such a way that the 6-inch inlet pipe has a good grade or slope to the tank, so that the water will have velocity enough to keep the pipe free at all times. You see the ends of the inlet and outlet pipes are submerged, which is done to exclude air and to prevent the breaking up of the scum on the surface of the contents of the tank, which acts as a sort of protective blanket for the bacteria.

The contents of the tank should be kept as quiet as possible, and as an aid in this matter we place a baffle board across the tank as shown. This baffle should rise a few inches above the surface line and have an open space 18 inches below it, to allow the heavy portion or sludge to spread over the whole bottom of the tank, where I believe it will be better taken care of by the bacterial action than it would in a smaller area.

Of course the 6-inch outlet pipe where it leaves the tank regulates the height of the material within, and is for the purpose of conducting the surplus water or effluent away to the place where it is finally disposed of. The outlet pipe should be set so as to allow an 18-inch air space above the flow or surface line.

Now as to the methods of disposing of the effluent. If you have to consider the protection of a water supply, as well as to dispose of the overflow, then you must conduct the effluent away to a point at least 200 feet from your own or a neighbor's water supply or any pond or stream connected with a supply.

Care must also be used so as not to dispose of the effluent in such a way that it can follow a ravine or depression in the ground surface that might convey it in a wrong direction. The best way of all would be to conduct it to a point under ground where there was a sand or gravel subsoil, and allow it to escape through a few open joints on the end of the outlet pipe, covering over the entire length of pipe.

In a properly constructed system there is so little sediment in the effluent that this underground outlet will dispose of it for an indefinite time in a porous material. Be sure and make tight joints in your pipes except at outlet end, and if you have to run either inlet or outlet pipes anywhere near a well it is advisable to use iron pipe at such a place and lead the joints.

I know of tanks that have been running now for several years, and have done the work so well that there is no amount of sludge in them at any time when opened. Members of the grange at several of the meetings have told their experience, and they expressed themselves as well satisfied, except in one instance, and that was when a double tank was used and the sludge accumulated in that one so as to block the inlet pipe. I think the tank must have been too small.

Now to return to the disposal of the effluent where you have no porous subsoil to take care of it. If you are located far from neighbors, and where you have a large area over which you can work without endangering any source of water supply, it would be all right to let the effluent run out onto the surface of the ground where it would get a good chance to spread out and not stand in pools, as of course mosquitoes would breed in the standing water.

Now there is another condition to consider, and that is where you have a limited area, and where you have to be careful about allowing the effluent, as it comes directly from the tank, to run out on the ground for fear of its going into some lake or stream that may carry it onto the land of another, and where it would be necessary to pass it through a sand filter before letting it pass off. A sand filter is easy to construct and adds greatly to the purity of the effluent.

Now a word in regard to waste water from the tank. Some people believe and some of the farm papers have stated that this water is good enough to drink; but it is not so, for you have not removed the bad matter entirely but have liquefied it and only made it possible to more easily dispose of the sewage.

The protection of the water supply by taking care of the sewage in this way would solve many vexatious problems.

How far-reaching the effect of using impure water may be can be illustrated by the thought of the awful possibilities of spreading a contagious disease by using this bad water to wash milk utensils, and as a means to cool milk by standing the cans in a tub of water in which there may be germs of typhoid fever. A farmer might be ever so particular about his cow barn, his cattle and himself and then use polluted water and thus his precautions be unavailing.

To illustrate the successful use of this system of sewage disposal I would like to tell you how, at Sugar Hill, New Hampshire, where the people depend upon money made by taking summer boarders, there were installed, at the suggestion of the New Hampshire State Board of Health, 30 or 40 of the tanks to eliminate a fly pest that was so severe that the summer people all went away. The help of the State Board was asked to remedy the difficulty, and an investigation showed that the flies were breeding and feeding in the open cesspools, privies and sink drains that were common at almost every place. After the sewage was taken care of by this method the flies disappeared and the summer people now go there as before. In their official reports they speak of the work and also published plans of a tank as designed by them.

The United States government and different States and colleges approve of this method of disposing of a serious menace to health in rural communities.

If you have conditions out of the ordinary by all means consult some one who understands the question thoroughly before spending your time and money.

The cost of the tank if constructed by your own labor should not be over $16 or $17; of course it is hard to say how much the piping would cost, as the lengths would vary for different cases.

AGRICULTURAL LEGISLATION,
1914.

AGRICULTURAL LEGISLATION, 1914.

PART I. — LEGISLATION CONFERRING POWERS AND DUTIES ON THE BOARD OF AGRICULTURE.

ADDITIONAL BOUNTY TO AGRICULTURAL SOCIETIES.

Chapter 209.

An Act relative to the granting of bounties to agricultural societies.

Be it enacted, etc., as follows:

Section 1. Chapter two hundred and sixty of the acts of the year nineteen hundred and twelve, as amended by chapter two hundred and forty of the acts of the year nineteen hundred and thirteen, is hereby further amended by striking out the word "October", in the sixth line, and inserting in place thereof the word: — August, — so as to read as follows: — Every incorporated agricultural society which is entitled to receive a bounty under section one of chapter one hundred and twenty-four of the Revised Laws, as amended by chapter one hundred and thirty-three of the acts of the year nineteen hundred and nine, shall be entitled to receive annually in August from the commonwealth, in addition to the sum which it is entitled to receive under the said section, four hundred dollars for the following purposes: — Two hundred dollars to be distributed in premiums to children and youths under eighteen years of age for the encouragement of horticulture, agriculture and domestic manufactures, subject to the discretion of each society drawing bounty; and two hundred dollars in general premiums; but no society shall receive a larger sum in addition to the bounty to which it is entitled under the said section than it shall have expended in the year last preceding in premiums, in excess of the sum to which it is entitled under the said section; nor in the case of the sum set apart in this act for premiums to children and youths a larger sum than it shall have expended for such premiums.

Section 2. This act shall take effect upon its passage. [*Approved March 19, 1914.*

SALE OF TRESPASS NOTICES.

Chapter 239.

An Act relative to the sale by the state board of agriculture of posters containing extracts from the trespass laws.

Be it enacted, etc., as follows:

Section 1. Section three of chapter four hundred and forty-four of the acts of the year nineteen hundred and four is hereby amended by inserting after the word "therefor", in the sixth line, the words: — to sell additional copies at not less than the cost thereof, — and by adding at the end thereof the words: — All amounts received from the sale of said posters shall be paid into the treasury of the commonwealth, — so as to read as follows: — *Section 3.* It shall be the duty of the said secretary to cause copies of said extracts to be printed on durable material, suitable to be affixed to trees or otherwise to be posted in the open air, to furnish not exceeding five copies in any one year without charge to any reputable person applying therefor, to sell additional copies at not less than the cost thereof, and annually on or before the first day of April, to send one such copy to each post office in the commonwealth. All amounts received from the sale of said posters shall be paid into the treasury of the commonwealth.

SECTION 2. This act shall take effect upon its passage. [*Approved March 24, 1914.*

PREMIUMS TO CHILDREN AND YOUTHS.

CHAPTER 267.

AN ACT TO PROVIDE FOR THE ENCOURAGEMENT OF AGRICULTURE AMONG CHILDREN AND YOUTHS.

Be it enacted, etc., as follows:

SECTION 1. Section one of chapter three hundred and nineteen of the acts of the year nineteen hundred and thirteen is hereby amended by striking out the word "one", in the first line, and inserting in place thereof the word: — two, — so as to read as follows: — *Section 1.* A sum not exceeding two thousand dollars may annually be expended by the state board of agriculture in premiums or otherwise, as the board shall determine, as rewards to children and youths under eighteen years of age for the purpose of stimulating interest and activity in agriculture. The board shall report annually to the legislature the names of the recipients of premiums or other rewards given hereunder, and the amount or value given to each.

SECTION 2. This act shall take effect upon its passage. [*Approved March 31, 1914.*

REGULATING PAYMENT OF BOUNTY TO AGRICULTURAL SOCIETIES.

CHAPTER 276.

AN ACT TO REGULATE THE PAYMENT OF BOUNTIES TO AGRICULTURAL SOCIETIES.

Be it enacted, etc., as follows:

SECTION 1. Section one of chapter one hundred and twenty-four of the Revised Laws, as amended by chapter one hundred and thirty-three of the acts of the year nineteen hundred and nine, and as affected by chapter two hundred and sixty of the acts of the year nineteen hundred and twelve, is hereby further amended by striking out the words "twenty-fifth day of

May in the year eighteen hundred and sixty-six", in the third and fourth lines, and inserting in place thereof the words: — thirty-first day of December in the year nineteen hundred and thirteen, — by striking out the word "twelve", in the sixth line, and inserting in place thereof the word: — twenty-five, — by striking out the word "October", in the fourteenth line, and inserting in place thereof the word: — August, — and by striking out the word "twelve", in the twenty-fifth line, and inserting in place thereof the word: — twenty-five, — so as to read as follows: — *Section 1.* Every incorporated agricultural society which was entitled to bounty from this commonwealth before the thirty-first day of December in the year nineteen hundred and thirteen, and every other such society whose exhibition grounds and buildings are not within twenty-five miles of those of a society which was then entitled to bounty, and which has raised by contribution of individuals and holds, as a capital appropriated to its uses, one thousand dollars, invested in an interest bearing public or private security or in real estate, buildings and appurtenances for its use and accommodation, shall, except when otherwise determined by the state board of agriculture as provided in section four, be entitled to receive annually in August from the commonwealth, two hundred dollars, and in that proportion for any greater amount so contributed and put at interest or invested; but no society shall receive a larger amount in one year than it has awarded and paid in premiums during the year last preceding, or otherwise expended for the encouragement and improvement of agriculture, with the approval of the state board of agriculture, nor, in any event, more than six hundred dollars. If there is only one incorporated agricultural society in any county, it shall be entitled to receive said bounty notwithstanding its exhibition grounds and buildings are within twenty-five miles of a society entitled to said bounty; and, after having received said bounty, it shall not be deprived of the right to receive the same by reason of the subsequent incorporation of another society within the same county.

Section 2. This act shall take effect upon its passage. [*Approved April 2, 1914.*

ANNUAL REPORT "AGRICULTURE OF MASSACHUSETTS."

Chapter 291.

An Act relative to the printing and distribution of the annual report of the state board of agriculture.

Be it enacted, etc., as follows:

Section 1. Section seven of chapter nine of the Revised Laws as amended is hereby further amended by striking out lines thirty-four to forty, inclusive, and inserting in place thereof the following: — Of the state board of agriculture, not more than ten thousand copies. Such parts of said report as the secretary of said board may deem best adapted to promote the interests of agriculture may be published separately, for general distribution, the expense of such publication to be met out of the appropriation for printing the report.

SECTION 2. Section eight of said chapter nine, as amended by chapter four hundred and twenty-two of the acts of the year nineteen hundred and eight, is hereby further amended by striking out lines eleven to thirteen, inclusive, and inserting in place thereof the following. — Each member of the general court and the clerk of each branch thereof shall also be entitled to receive, upon application, not more than twenty-five copies each of such parts of the annual report of the state board of agriculture as may be published separately in accordance with the preceding section, — so that the last paragraph of said section eight will read as follows· — Each member of the general court and the clerk of each branch thereof shall also be entitled to receive, upon application, not more than twenty-five copies each of such parts of the annual report of the state board of agriculture as may be published separately in accordance with the preceding section, seven additional copies of the report of the board of health, and of the report of the bureau of statistics of labor; five additional copies of the report of the secretary of the board of education, and of the report of statistics of manufactures.

SECTION 3. This act shall take effect upon its passage. [*Approved April 3, 1914.*

POULTRY PREMIUM BOUNTY.

CHAPTER 298.

AN ACT TO ENCOURAGE AND IMPROVE THE BREEDING OF POULTRY.

Be it enacted, etc., as follows:

SECTION 1. Section one of chapter four hundred and twenty-eight of the acts of the year nineteen hundred and nine, as amended by chapter five hundred and ninety of the acts of the year nineteen hundred and thirteen, is hereby further amended by striking out said section, and inserting in place thereof the following new section: — *Section 1.* The sum of two thousand dollars shall be paid annually from the treasury of the commonwealth to the board of agriculture, which shall be known as a poultry premium bounty, and shall be used by the said board to encourage and improve the breeding of poultry. Said bounty shall be distributed by said board among the poultry associations hereinafter designated, during the month of August in each year, in proportion to the total amounts paid out by such associations, respectively, during the year ending June thirtieth, as hereinafter provided, in state premiums for such breeds and strains of poultry as the said board shall consider most worthy of encouragement, and the sum so distributed shall be used by such associations for the purpose of enabling them to hold annual exhibitions of poultry and for the payment of premiums only. The board may make such rules as it may deem suitable for carrying out the provisions of this act; and any part of said bounty not distributed by the board in any year shall be repaid by it to the treasurer and receiver general.

SECTION 2. Said chapter four hundred and twenty-eight is hereby further amended by striking out section three and inserting in place thereof the following new section: — *Section 3.* No association shall be entitled to any part of said bounty unless it shall certify to the board of agriculture, not later than the tenth day of July, under the oath of the president and treasurer of such association, that it has held an exhibition of poultry during the year ending June thirtieth, the amount paid in premiums by the association at such exhibition, and that the association is in need of aid to enable it to continue its exhibitions of poultry, together with such other facts as the board may request.

SECTION 3. For the purposes of this act the term "state premiums", shall mean all premiums described in the premium lists of said associations as being offered by the state board of agriculture through the association.

SECTION 4. This act shall take effect on the first day of July in the year nineteen hundred and fourteen, but nothing herein shall be construed as affecting returns required to be made hereunder prior to the tenth day of July in the year nineteen hundred and fifteen. [*Approved April 6, 1914.*

DRAINAGE OF WET LANDS.

CHAPTER 596.

AN ACT FURTHER TO PROVIDE FOR THE RECLAMATION OF WET LANDS.

Be it enacted, etc., as follows:

SECTION 1. The joint board established by chapter seven hundred and fifty-nine of the acts of the year nineteen hundred and thirteen may, in its discretion, in order further to carry out the purposes of said chapter, purchase any wet lands at a price not exceeding the assessed valuation thereof, and may accept on behalf of the commonwealth gifts of land to be drained and reclaimed as herein provided. The sellers or donors of such lands may reserve the right to buy back the land at any time within two years upon paying the price originally paid by the commonwealth, together with the amount expended in improvements and maintenance, and interest at the rate of four per cent per annum, but in the absence of a provision to that effect in the deed of purchase or gift the former owner shall not have such right, and the lands so acquired shall be offered for sale, in whole or in part, by the said joint board, at such time or times as it shall deem expedient, at a price not less than the cost of the land plus the cost of reclaiming the same, and interest at the rate of four per cent per annum.

SECTION 2. Section five of said chapter is hereby amended by inserting after the word "cultivation", in the sixth line, the words: — except hay sold in the bale, — so as to read as follows: — *Section 5.* When said lands, or any convenient part thereof, shall have been drained and reclaimed, the said joint board shall cause the same to be cultivated for not less than two successive seasons, in such manner as in the opinion of the board will best demonstrate the value thereof for agricultural uses. The products of cultivation, except hay sold in the bale, shall not be sold in open market, but shall be used for the supply of public institutions, and such institutions shall pay to the joint board such sums for the said products as they would pay if the same were purchased in open market, and the sums so received shall be added to the sum herein provided for.

Section 3. In carrying out the provisions of this act, and of said chapter seven hundred and fifty-nine of the acts of the year nineteen hundred and thirteen, the joint board may expend a sum not exceeding ten thousand dollars, from the treasury of the commonwealth, in addition to the sums authorized by section seven of said chapter. [*Approved June 2, 1914.*

Chapter 759 of the Acts of 1913 designated the State Board of Agriculture and the State Board of Health as a joint board for the reclamation of wet lands, and appropriated $15,000 for this work.

PART II. — LEGISLATION REFERRING TO FORESTRY.

DISPOSAL OF SLASH.

Chapter 101.

An Act relative to the disposal of slash or brush following wood or lumber operations.

Be it enacted, etc., as follows:

Section 1. Every owner, tenant or occupant of land, and every owner of stumpage, who cuts or permits the cutting of wood or timber on woodland owned or occupied by him or on which he has acquired stumpage by purchase or otherwise, and which borders upon the woodland of another or upon a highway or railroad location, shall clear the land of the slash and brush wood then and there resulting from such cutting for such distance, not exceeding forty feet, from the woodland of such other person, highway or railroad location as the local forest warden shall determine, and within such time and in such manner as he shall determine.

Section 2. Any person who cuts or causes to be cut trees or bushes or undergrowth within the limits of any highway or public road shall dispose of the slash and brush wood then and there resulting from such cutting within such time and in such manner as the forest warden of the city or wherein such cutting is done shall determine.

Section 3. Whoever neglects to comply with the directions of the forest warden with regard to the disposal of slash and brush, as provided in sections one and two of this act, may be punished by a fine of not less than five dollars nor more than fifty dollars.

Section 4. This act shall take effect on the first day of January in the year nineteen hundred and fifteen. [*Approved February 25, 1914.*

TAXATION OF WOODLAND.

Chapter 598.

An Act to provide for the classification and taxation of wild or forest land.

Be it enacted, etc., as follows:

Section 1. Owners of woodland or land suitable for forest planting may have such land classified for taxation under the following designations: —

(*a*) Land with trees of merchantable value shall be known as Woodlot.

(*b*) Land without trees of merchantable value shall be known as Plantation.

No tract of land containing less than three acres shall be classified unless such tract is to be consolidated with other tracts under the provisions of section thirteen of this act.

CLASSIFICATION.

Section 2. Any owner of land suitable for classification as Woodlot or Plantation who desires to have it classified shall make application, in such form as the tax commissioner shall from time to time prescribe, to the clerk of the city or town in which the land is situated. The application shall state whether or not the land is encumbered by mortgages, leases, attachments, or other valid liens, except rights of way; and shall state also whether other persons than the applicant have an interest or interests in the land. In either case, the application shall be accompanied by the written assent to the classification of such mortgagees, lessees, attaching creditors or lienors, or persons having an interest in the land, which assent shall be under seal and in such form as the tax commissioner shall from time to time prescribe. The application shall be accompanied by such description by metes and bounds as may be contained in the last conveyance of the land, or by two copies of a plat showing the location of the land by metes and bounds, and in either case shall contain a reference to the book and page of the record of said conveyance. If the land to be classified comprises a part of the land described in any conveyance, said application shall be accompanied by such a description by metes and bounds as will be sufficient to identify that part, or by two copies of a plat showing the location of the part by metes and bounds, and in either case shall give a reference to the book and page of the record of said conveyance. The clerk of the city or town in which the land is situated shall forthwith notify the assessors of such city or town of the filing of the application. The assessors shall forthwith determine whether the land is suitable for classification; and if they so determine, shall within thirty days make separate valuations of the land and of the value of the trees growing thereon, which value shall be the fair cash value of the trees on the stump. hereinafter called stumpage value. The assessors shall make separate valuations of any buildings on the land. They may also require the forest warden of the city or town to give such assistance as they may deem necessary in making the aforesaid determinations and valuations. If the assessors shall determine that the land is not suitable for classification as aforesaid, they shall forthwith give notice thereof to the owner, who may appeal from such decision to the state forester. The state forester, after investigation and after hearing the persons interested, shall decide whether the land is suitable for classification, and shall notify the owner and the assessors of his decision. If he shall decide that the land is suitable for classification, the assessors shall, within thirty days thereafter, make the aforesaid valuations.

Section 3. Said assessors shall, within ten days after the completion of said valuations, send written notice thereof, in such form as the tax commissioner shall from time to time prescribe, to the owner of the land; and the valuations so determined shall be conclusive unless the owner, within ten days after receiving them, files notice of an appeal to the tax commissioner from any or all of the valuations so determined. In case of such appeal, the tax commissioner or his deputy, after investigation and after hearing the persons interested, shall make final determination of said valuation or valuations, and shall notify the owner and the assessors of such determination, which shall be conclusive.

Section 4. Upon the final determination of the aforesaid valuations, the owner, if he desires to complete the classification, shall, within ten days, notify the clerk of the city or town of his acceptance of such valuations; and such notification shall constitute a full acceptance of the conditions and requirements of this act. The clerk may, with the consent of the tax commissioner, receive and file the notification after the said time has elapsed. Upon receipt of such notification, the clerk shall forthwith classify the land and shall notify the assessors of the city or town in which the land is situated; but if the notification from the owner is not received on or before the first day of April in any year, the provisions of this act relating to taxation shall not take effect until the first day of April of the following year: *provided*, that in the year nineteen hundred and fourteen said provisions relating to taxation shall take effect as of the first day of April, if the aforesaid notification from the owner is received on or before the first day of July. The clerk shall also cause to be recorded in the registry of deeds for the county in which the land is situated a certificate of the classification of the land, which certificate shall contain the name of the owner of the land, the date of classification, the designation of the land classified, and a copy of the description of the land, or of the plat, required by section two of this act. The clerk shall receive from the applicant a fee of two dollars for every such certificate of classification, and shall receive a fee of fifty cents for each subsequent copy thereof; and in addition the clerk shall receive the usual fee for recording said certificate in the registry of deeds, which fee shall be transmitted with the certificate to the register of deeds. Upon the recording of the certificate, the land shall thereafter be subject to all the conditions and requirements of this act unless it is withdrawn from classification; and said conditions and requirements shall be binding upon any owner thereof, his heirs and assigns, upon all persons who have assented to the classification, and upon all persons subsequently acquiring any interest in the land.

TAXATION OF CLASSIFIED FOREST LAND.

SECTION 5. Land classified under this act shall be exempt from taxation except such as is imposed by this act, but shall be liable to the same extent and in the same manner as other land for special assessments. Buildings situated upon such land shall be subject to taxation as real estate under the provisions of chapter four hundred and ninety of the acts of the year nineteen hundred and nine and acts in amendment thereof and in addition thereto.

FOREST LAND TAX.

SECTION 6. Land classified under the provisions of this act shall be subject to forest land tax. Said tax shall be assessed, levied and collected in the manner prescribed in chapter four hundred and ninety of the acts of the year nineteen hundred and nine for the taxation of real estate within the commonwealth, upon its fair cash value exclusive of the value of all buildings and the value of all trees growing thereon: *provided*, that owners of classified land, instead of prosecuting an appeal, as provided in sections seventy-six to eighty of Part I of the said chapter, as amended, may, at their option, within thirty days after receiving the notice provided for by section seventy-five of Part I of the said chapter appeal to the tax commissioner. If the tax commissioner or his deputy, upon a hearing, finds that the land has been overvalued, he shall make a reasonable abatement and an order as to costs.

FOREST COMMUTATION TAX.

SECTION 7. Land classified under this act as Woodlot shall be subject to forest commutation tax, which shall be assessed and levied annually as of April first by each city and town in the following manner: —

(*a*) An account shall be opened by the assessors of each city or town for all lands classified as Woodlot on or before April first, nineteen hundred and nineteen, and not withdrawn, which account shall show the sum of the taxes assessed upon such lands, exclusive of buildings thereon, in the year nineteen hundred and thirteen.

(*b*) From the aforesaid sum there shall be deducted, in each year from nineteen hundred and fourteen to nineteen hundred and nineteen, inclusive, the total amount of forest land tax assessed for that year in the city or town, and the remainder shall be the total amount of forest commutation tax of the city or town for that year.

(*c*) The total amount of forest commutation tax thus determined for each year from nineteen hundred and fourteen to nineteen hundred and nineteen, inclusive, shall then be apportioned to the various tracts of Woodlot, in proportion to the stumpage value of the trees growing thereon at the date of classification, as determined in accordance with section two of this act; and the several amounts thus ascertained shall be the amounts of forest commutation tax for which said tracts shall respectively be liable for that year.

(*d*) Upon the completion of the assessments for the year nineteen hundred and nineteen the account provided for in subsection (*a*) shall be closed; and each tract of Woodlot classified on or before the first day of April of that year shall thereafter be liable for the same amount of forest commutation tax that was levied in the said year nineteen hundred and nineteen, except as provided in subsections (*g*), (*h*), (*i*), and (*j*) of this section.

(*e*) Upon every tract of land classified as Woodlot in any city or town after April first, nineteen hundred and nineteen, the annual amount of forest commutation tax shall be the amount of tax assessed and levied upon such tract, exclusive of the buildings thereon, in the last assessment and levy prior to the date of classification, less the amount of forest land tax assessed and levied in the next assessment and levy subsequent to said date of classification.

(*f*) Forest commutation tax shall be collected in the manner prescribed by Part II of chapter four hundred and ninety of the acts of the year nineteen hundred and nine for the taxation of real estate within the commonwealth and acts in amendment thereof and in addition thereto.

(*g*) In case of the destruction by fire or otherwise on or before April first, nineteen hundred and nineteen, of trees standing upon land classified as Woodlot, the owner of the land may apply to the assessors of the city or town for a reduction of forest commutation tax. Such application shall not be made except in respect of trees of a value equal to or in excess of ten per cent of the stumpage value of the trees standing on the land at the time of classification. The assessors shall determine what proportion of said stumpage value of the trees has been destroyed by fire or otherwise, and shall make a proportionate reduction in the valuation of said trees in determining the amount of forest commutation tax which the land shall thereafter pay. The assessors may require the forest warden of the city or town to give such assistance as may be necessary in determining the proportion of stumpage value so destroyed. The assessors shall also deduct from the total amount of forest commutation tax thereafter levied in the city or town an amount of tax proportionate to any and all reductions in valuations made to landowners in accordance with the provisions of this subsection. From the aforesaid determination of the assessors, the owner may appeal to the tax commissioner in the manner provided in section six of this act.

(*h*) In case of the destruction by fire or otherwise, subsequent to April first, nineteen hundred and nineteen, of trees standing upon land classified as Woodlot under this act, the owner of the land may apply to the assessors of the city or town for a reduction of forest commutation tax. Such application shall not be made except in respect of trees of a value equal to or in excess of ten per cent of the stumpage value of the trees standing on the land at the time of classification. The assessors shall determine what amount and proportion of said stumpage value of the trees has been destroyed by fire or otherwise, and shall make a proportionate reduction in the forest commutation tax for which the owner shall be liable, The assessors may require the forest warden of the city or town to give such assistance as may be necessary in determining the proportion of stumpage value so destroyed. From the determination of the assessors, the owner may appeal to the tax commissioner in the manner provided in section six of this act.

(*i*) On and after April first, nineteen hundred and nineteen, any owner of land classified as Woodlot may, as hereinafter provided, apply to the assessors of the city or town for a reduction of the amount of forest commutation tax for which the owner is liable. Such application may be made only in respect to trees upon which forest product tax has been paid; and may not be made except in respect of trees of a stumpage value equal to or in excess of ten per cent of the stumpage value of the trees standing upon the land at the date of classification. Upon receipt of such application, the assessors of the city or town shall reduce the forest commutation tax for which the owner is liable in any subsequent year, by a percentage equal to the percentage which the stumpage value of the trees bears to the stumpage value of the trees standing upon the land at the date of classification.

(*j*) When the reductions in valuations made in accordance with subsections (*g*), (*h*) and (*i*) shall equal the stumpage value of the trees determined to have been standing on the Woodlot at the date of classification, the Woodlot shall no longer be liable for forest commutation tax and shall thereafter be treated as if it had been classified as Plantation.

FOREST PRODUCT TAX.

SECTION 8. All land classified under this act shall be subject to forest product tax, which shall be assessed, levied and collected in the following manner: —

(*a*) Except as provided in subsection (*e*) of this section, every owner of land classified under this act shall, on or before the first day of May in each year, report to the assessors of the city or town in which the land is situated, under oath, in such form as the tax commissioner shall from time to time prescribe, the gross amount and stumpage value of all wood cut from the land during the twelve months preceding the first day of April, as well as the gross amount of all other products of the land and such other income derived from the land as does not constitute an element determining the value of the land for the purpose of assessing forest land tax. In the case of wood, the aforesaid value shall be the stumpage value, and in other cases it shall be the fair cash value.

(*b*) Except as is provided in subsection (*e*) of this section, immediately after the cutting of trees and not less than ten days before the removal of any wood from land classified under this act, the owner shall notify the assessors of such intended removal and shall report the amount and stumpage value of such wood. Every such owner or his agent or representative who fails to comply with the foregoing requirement shall be liable to a fine of not less than ten nor more than one thousand dollars. The assessors shall have the right, after inspection, to make an independent determination of the amount of such wood or the stumpage value thereof, or both, and shall forthwith notify the owner thereof. The assessors may require the forest warden of the city or town to give such assistance as may be necessary. Such determination shall be final and conclusive unless the owner shall forthwith file with the assessors either a notice of an appeal to the state forester or a written request for an arbitration. Such appeal or arbitration may be had as to the amount or stumpage value of the wood, or both. Upon such appeal, the state forester or his assistant shall, after inspection, make final determination thereof and an order as to costs. If arbitration be requested, the arbitration shall be by three disinterested persons, one to be chosen by the owner, one by the assessors, and the third by the agreement of the two thus chosen; and the decision of the arbitrators shall be final and conclusive. The fees and expenses of the arbitrators shall be paid by the city or town, and one half the amount thereof shall be assessed upon the land and included in the next warrant committed by the assessors to the collector of taxes for the collection of forest product tax.

Under such regulations as the tax commissioner may prescribe, owners of land may, with the written consent of the tax commissioner, be exempted from the requirements of this subsection; and the aforesaid regulations shall govern the determination of amounts and stumpage values of wood for the assessment and levy of forest product tax.

(*c*) Except as provided in subsection (*e*) of this section, forest product tax shall annually be assessed and levied upon the gross value of all wood, other products and other income ascertained as provided in subsections (*a*), (*b*) and (*d*) of this section, at the following rates: — For wood cut or other products or income derived from the land prior to the first day of April, nineteen hundred and nineteen, the tax thereon shall be one per cent; from said first day of April, nineteen hundred and nineteen, to the thirty-first day of March, nineteen hundred and twenty-four, inclusive, two per cent; from the first day of April, nineteen hundred and twenty-four, to the thirty-first day of March, nineteen hundred and twenty-nine, inclusive, three per cent; from the first day of April, nineteen hundred and twenty-nine, to the thirty-first day of March, nineteen hundred and thirty-four, inclusive, four per cent; from the first day of April, nineteen hundred and thirty-four, to the thirty-first day of March, nineteen hundred and thirty-nine, inclusive, five per cent; and on and after the first day of April, nineteen hundred and thirty-nine, six per cent.

(*d*) Except as provided in subsection (*e*) of this section, the assessors of each city or town shall annually, between the first day of April and the last day of July, assess and levy a forest product tax upon the persons or corporations owning classified land upon the first day of April in such year.

They shall receive as true the reports required in subsection (*a*) of this section, except as such reports may be revised in accordance with the provisions of subsection (*b*), but, upon information, may add thereto the value of any products not reported, and, upon information, may revise the amount and valuation of products other than wood and of the other income derived from classified land. Notification of all assessments shall be sent to all taxable persons not later than the first day of September in each year, and taxable persons aggrieved by such assessments, other than assessments of wood, may apply for an abatement thereof in the manner provided by sections seventy-two to eighty-two, inclusive, of Part I of chapter four hundred and ninety of the acts of the year nineteen hundred and nine and acts in amendment thereof and in addition thereto.

(*e*) Any owner, other than a corporation, of classified lands may remove from such lands annually an amount of wood not exceeding twenty-five dollars in stumpage value, without making the reports, giving the notifications, or being liable for the tax required in subsections (*a*), (*b*), (*c*) and (*d*) of this section: *provided*, that the wood is for his personal use, or for the use of his tenant. Such wood may subsequently be sold upon making the aforesaid reports and paying forest product tax thereon.

(*f*) Forest product tax shall be a lien upon the land in respect of the product or income from which it was assessed, and shall be collected in the manner prescribed in said chapter four hundred and ninety: *provided*, that if the assessors of the city or town, to insure the collection of said tax, deem it necessary, they may require of the owner either a cash deposit of the amount of forest product tax as estimated by the assessors, or, at his option, a bond with good and sufficient sureties conditioned upon the payment of the tax when levied. When such demand is made, the wood in respect of which forest product tax is payable shall not be removed from the land until the owner has complied with said demand, and any person who shall so remove said wood shall be liable to a fine of not more than five hundred dollars or to imprisonment for not more than sixty days, or to both such fine and imprisonment. Forest product tax shall constitute a lien upon the wood or other product in respect to which it was assessed for so long as the wood or other product is in the possession of the owner of the land from which it was produced, or of a person taking the same with knowledge that the assessors have required security for the tax and that such security has not been given; and any person taking said wood with such knowledge shall be liable for the amount of the tax.

CONSOLIDATION OF CLASSIFIED LANDS.

SECTION 9. On and after the first day of April, nineteen hundred and nineteen, any owner of two or more adjoining tracts of land classified in any city or town as Woodlot or Plantation, and any owner of more than one hundred acres of land so classified, whether the land consists of adjoining tracts or not, may apply for the consolidation of such tracts under a single classification. The application shall be in such form as the tax commissioner shall from time to time prescribe, and shall be filed with the clerk of the city or town in which said tracts are situated. The clerk shall forthwith classify the tracts as a single tract, shall record the classification in the registry of deeds, as provided in section four of this act, and shall receive therefor a fee, together with the fee required for such recording, as provided in said section four. He shall forthwith notify the assessors of the city or town of such consolidation, and the assessors shall, on or before the first day of the following April, consolidate the valuations and assessments of all taxes imposed by this act, which taxes shall, on and after the aforesaid first day of April, be levied and assessed in respect of the entire tract of land classified, and not in respect of its constituent tracts of Woodlot or Plantation. Such consolidated tract shall be known as Forest.

SALES OF PORTIONS OF CLASSIFIED LANDS.

Section 10. No sale or other conveyance of classified land shall release the purchaser thereof, or other person acquiring an interest in such land, from any obligation or liability imposed by this act. Not less than ten days before the sale or conveyance of classified land upon which forest product tax has accrued or has been assessed, the owner of the land shall notify the assessors of the city or town in which the land is situated of the contemplated transfer, and the assessors may, if they deem it necessary to insure the collection of the tax, require of the owner either a cash deposit of the amount of forest product tax estimated to have accrued or actually assessed, or, at his option, a bond with good and sufficient sureties conditioned upon the payment of the tax.

Section 11. In case of the sale of any part of any tract of land, the owner of which is liable to the payment of forest commutation tax, the parties to such sale shall agree upon an equitable division of the aforesaid tax. A copy of this agreement signed by all of the parties to the conveyance shall forthwith be filed with the assessors of the city or town in which the land is situated, who shall accept the aforesaid division as the basis for the future assessment and levy of forest commutation tax, unless they find the division so unequal as to reduce the security of the city or town for the collection of any part of the forest commutation tax thereafter. Until such division of tax shall have been accepted by the assessors, the parties to any such sale or conveyance, and their heirs and assigns, shall be jointly and severally liable for all forest commutation taxes thereafter assessed in respect of the entire tract of land.

WITHDRAWALS.

Section 12. Land classified under this act may be withdrawn from classification by the owner at any time upon payment to the authorities of the city or town in which the land is situated of the amount of forest land tax and forest commutation tax which may be due for the current year and for all previous years, and upon payment of forest product tax upon the stumpage value of the trees then standing upon such land, as though the said trees had then been cut. The owner shall give the assessors of the city or town in which the land is situated notice in writing of his desire to withdraw the land from classification. The assessors shall forthwith make a valuation of the trees then standing upon the land, and give notice of such valuation and of the amount of forest product tax due thereon for such withdrawal; and may require the forest warden of the city or town to give such assistance as may be necessary. If the owner of the land is aggrieved by the valuation made by the assessors, he may, within ten days after such notice, appeal to the state forester, or make a written request to the assessors for an arbitration, which arbitration shall be in accordance with the provisions of subsection (*b*) of section eight of this act. Upon the payment of the forest product tax thereon and of all other taxes due on account of the land, the land shall be withdrawn from classification. The clerk of the city or town shall forthwith record a certificate of such withdrawal in the registry of deeds for the county in which the land is situated. The owner of the land shall pay to the clerk a fee of one dollar for every such certificate of withdrawal, and a fee of fifty cents for each subsequent copy thereof; and in addition, the usual fee for recording said certificate in said registry, which fee the clerk shall transmit to the register of deeds.

In case of all trees cut on said land within three years of the date of such withdrawal, a forest product tax shall be assessed in accordance with the provisions of this act; and if the amount of tax thus assessed in respect to the land shall exceed the amount of tax assessed and levied at the time of withdrawal, the owner shall be liable for the payment of such excess under the conditions and requirements of section eight of this act.

REPORTS OF ASSESSORS.

SECTION 13. The assessors of each city and town shall annually report to the tax commissioner, in such form as he shall from time to time prescribe, the following information: —

(*a*) The amount of land classified in accordance with the provisions of this act.

(*b*) The valuation of said land for the assessment and levy of forest land tax.

(*c*) The amount of forest land tax levied and assessed.

(*d*) The amount of forest commutation tax levied and assessed.

(*e*) The amount and valuation of wood and the value of other forest products and income upon which forest product tax is levied and assessed.

(*f*) The amount of forest product tax levied and assessed.

DUTIES OF THE TAX COMMISSIONER.

SECTION 14. The tax commissioner shall from time to time prepare instructions which shall be followed by the assessors of the cities and towns in the assessment and levy of the taxes authorized by this act, and shall prescribe such forms and procedure as he may deem necessary for the administration of said taxes. He shall compile and cause to be printed annually in the aggregate returns required by section sixty-two of Part I of chapter four hundred and ninety of the acts of the year nineteen hundred and nine the information furnished by the assessors of the various cities and towns in accordance with the provisions of section thirteen of this act.

He may also call upon individuals, firms or corporations owning land classified under this act for a statement of the amount and value of the wood or other products and income derived from such land, and may examine the books, accounts and papers of such individuals, firms and corporations so far as may be necessary for the verification of the said statement.

SECTION 15. In determining the basis for the apportionment of state and county taxes subsequent to the passage of this act, the tax commissioner shall not include in the valuation of property subject to taxation in any city or town, the valuation of trees standing upon land classified under this act. Of the whole amount of forest product tax levied and assessed in any city or town, ten per cent shall be for the use of the commonwealth, and the treasurer of each city or town shall, on or before the fifteenth day of November in each year, pay to the treasurer and receiver general of the commonwealth the said proportion of forest product tax.

ADMINISTRATION.

SECTION 16. The state forester shall from time to time issue such regulations as are required by sections seventeen and nineteen of this act, and shall furnish copies thereof free of charge to the clerks, assessors and forest wardens of the cities and towns of the commonwealth and to such other persons as may apply therefor.

SECTION 17. Owners of classified land shall, within three years after the date of classification, seed or plant any parts of such tracts that are suitable for seeding or planting and have not been naturally re-stocked: *provided*, that with the written approval of the state forester the time for seeding or planting may be extended. The state forester shall from time to time make regulations to insure such seeding or planting, which regulations shall permit any approved forestry methods and shall not require the expenditure of more than ten dollars per acre.

SECTION 18. Whenever any area of classified land equal to or in excess of three acres in extent is cleared of trees, the owner thereof shall either leave a suitable number of trees to provide for the re-seeding of the tract; or shall, unless the land is naturally re-stocked within two years, re-seed or plant the land in accordance with the aforesaid regulations. If the owner shall elect to leave seed trees, and the land is not naturally re-stocked therefrom within a period of three years thereafter, the owner shall re-seed or plant the land or parts thereof, in accordance with the aforesaid regulations of the state forester. In either of the above cases, the state forester may extend the time for re-seeding or planting.

SECTION 19. When trees are cut from any classified land, the owner of the land shall make such disposition of the slash as may be required by such regulations as the state forester shall from time to time prescribe: *provided,* that such regulations shall permit of any approved forestry methods.

SECTION 20. If any owner of classified land fails to comply with the regulations of the state forester as to the seeding and planting of the land or disposal of slash required under sections seventeen to nineteen, inclusive, the state forester may cause the land to be thus seeded or planted or such slash to be disposed of, and the owner of the land shall be liable to the commonwealth for the expense thereof: *provided,* that such planting shall not exceed in cost ten dollars per acre.

If the owner, after notification from the state forester that the requirements of said regulations have not been complied with, fails to comply therewith within a reasonable time thereafter, the state forester, after a hearing, shall have the right to direct the clerk of the city or town to cancel the classification of the land. The clerk shall forthwith cancel the classification, notify the assessors thereof, and record a certificate of cancellation in the registry of deeds. The assessors shall forthwith make a valuation of the trees standing upon the land, and assess a forest product tax thereon, which shall forthwith be levied and shall be collected in accordance with the provisions of section eight of this act.

SECTION 21. For services rendered under the provisions of sections two, seven, eight and twelve, the forest warden of a city or town shall receive from the city or town the compensation provided by section twenty-three of chapter thirty-two of the Revised Laws.

PENALTIES.

SECTION 22. Any applicant for the classification of land under this act who fraudulently fails to disclose all encumbrances thereon or interests therein then existing, shall be punished by a fine of not more than one thousand dollars, or by imprisonment for not more than one year.

SECTION 23. Any person violating any requirement of this act for which no specific penalty is provided, shall be punished by a fine of not more than one hundred dollars.

ORGANIZATION AND TAXATION OF CORPORATIONS FORMED FOR THE PURPOSE OF OWNING CLASSIFIED LANDS.

SECTION 24. Section seven of chapter four hundred and thirty-seven of the acts of the year nineteen hundred and three, as amended by chapter two hundred and eighty-six of the acts of the year nineteen hundred and six, and by chapter five hundred and ninety-five of the acts of the year nineteen hundred and twelve, is hereby further amended by adding at the end of said section the following words: — and *provided, further,* that corporations formed for the purpose of owning classified forest land under the provisions of the forest classification and taxation act may be organized without limitation of the term of their duration, — so as to read as follows: — *Section 7.* Three or more persons may associate themselves by a written agreement of association with the intention of forming a corporation under the general laws for any lawful purpose which is not excluded by the provisions of section one: *provided,* that the agreement of association of a corporation formed for the purpose of acquiring, holding, managing, improving, leasing, buying and selling real estate shall state the term of the duration of the corporation, such term not to exceed fifty years; and *provided, further,* that corporations formed for the purpose of owning classified forest land under the provisions of the forest classification and taxation act may be organized without limitation of the term of their duration.

SECTION 25. In the taxation of corporate franchises, under the provisions of sections forty to forty-three, inclusive, of Part III of chapter four hundred and ninety of the acts of the year nineteen hundred and nine, and acts in amendment thereof, and in addition thereto, corporations organized for the purpose of owning land classified under the provisions of this act shall be exempt from taxation upon such proportion of their capital stock as is actually invested and employed in the business of forestry upon land classified under the provisions of this act.

REGISTRATION OF LAND NOW EXEMPT FROM TAXATION.

SECTION 26. Section six of Part I of chapter four hundred and ninety of the acts of the year nineteen hundred and nine is hereby repealed, but this repeal shall not affect exemptions existing at the date of the passage of this act. Owners of land exempt from taxation under the provisions of said section may, at the end of the period provided by said section, classify such land as Plantation under this act. When such land is thus classified as Plantation, the assessors shall not be required to value the trees standing thereon, but shall make the other valuations required by section two of this act.

SECTION 27. This act shall be known as the forest classification and tax act.

SECTION 28. This act shall take effect upon its passage. [*Approved June 2, 1914.*

FOREST COMMISSION ESTABLISHED.

CHAPTER 720.

AN ACT TO ESTABLISH A STATE FOREST COMMISSION AND TO PROVIDE FOR THE PURCHASE OF LANDS FOR STATE FORESTS.

Be it enacted, etc., as follows:

SECTION 1. There is hereby established a state forest commission, to be composed of three persons, one of whom shall be the state forester and two other members who shall be appointed by the governor, with the advice and consent of the council, and who shall serve without compensation.

The term of office of the appointive members of the commission shall be six years, except that when first appointed one of the members shall be appointed for six years and one for three years. Thereafter one member shall be appointed every third year.

SECTION 2. The commission shall have power to acquire for the commonwealth by purchase or otherwise, and to hold, woodland or land suitable for timber cultivation within the commonwealth. The commission may, after a public hearing, sell or exchange any land thus acquired which in the judgment of the commission can no longer be used advantageously for the purposes of this act. The average cost of land purchased by the commission shall not exceed five dollars an acre.

SECTION 3. Lands acquired under the provisions of this act shall be known as state forests and shall be under the control and management of the state forester. He shall proceed to re-forest and develop such lands and shall have power to make all reasonable regulations which in his opinion will tend to increase the public enjoyment and benefit therefrom and to protect and conserve the water supplies of the commonwealth. The state forester shall keep and shall publish in his annual report an account of all money invested in each state forest, and of the annual income and expense thereof.

SECTION 4. In the reforestation, maintenance, and development of lands purchased under this act, the state forester, so far as it is practicable, shall obtain the labor necessary therefor under the provisions of chapter six hundred and thirty-three of the acts of the year nineteen hundred and thirteen, and acts in amendment thereof and in addition thereto.

SECTION 5. Land acquired under the provisions of this act shall be exempt from taxation; but the commonwealth shall reimburse cities and towns in which such lands are situated for taxes lost by reason of their acquisition, in the same manner and to the same extent as in the case of lands acquired for public institutions under the provisions of chapter six hundred and seven of the acts of the year nineteen hundred and ten.

SECTION 6. The sum of ten thousand dollars may be expended during the present year and the sum of twenty thousand dollars may be expended annually for the four succeeding years by the state forest commission in the acquisition of lands under the provisions of this act: *provided*, that the said commission may, at its discretion, authorize the state forester to expend a part of said sum in the maintenance of said lands. If any part of said twenty thousand dollars remains unexpended at the close of any year, the balance may be expended in the following year. The said commission may also expend not more than five hundred dollars annually for its necessary expenses incurred in carrying out the provisions of this act.

SECTION 7. This act shall take effect upon its passage. [*Approved June 29, 1914.*

PART III. — LEGISLATION OF GENERAL AGRICULTURAL INTEREST.

SHOOTING OF PHEASANTS.

Chapter 401.

An Act relative to the killing of pheasants.

Be it enacted, etc., as follows:

Section 1. The board of commissioners on fisheries and game may declare an open season on pheasants in any county of the commonwealth, in which such open season seems advisable, and may make such rules and regulations relating to bag limit, time and length of open season and varieties to be taken and all other matters connected with such open season as the said board may from time to time deem necessary or expedient.

Section 2. A person may capture, pursue, wound or kill, upon land owned or occupied by him, a pheasant which he finds in the act of doing damage to any crop on cultivated land; and he may authorize a member of his family or person permanently employed by him on such land to capture, pursue, wound or kill a pheasant under the circumstances above specified. The person by whom or under whose direction a pheasant is so captured, wounded or killed shall within twenty-four hours report the facts in writing to the said board, stating the time, place and the number of pheasants so captured, wounded or killed.

Section 3. Whoever violates any provision of this act or any rule or regulation made under authority hereof shall be punished by a fine not exceeding fifty dollars for each bird or part thereof in respect to which the violation occurs.

Section 4. All acts and parts of acts inconsistent herewith are hereby repealed. [*Approved April 23, 1914.*

SUPPRESSION OF INSECT PESTS.

Chapter 404.

An Act to authorize cities and towns to suppress the tent caterpillar, leopard moth and elm beetle.

Be it enacted, etc., as follows:

Section 1. The city forester, superintendent or other person having charge of the suppression of gypsy and brown tail moths in each city and town in the commonwealth, or, where there is no such person, the tree warden, may destroy within the limits of his city or town the tent caterpillar, leopard moth and elm beetle, if authorized so to do by the mayor and city council or commission in cities, or by the selectmen in towns.

Section 2. For the purposes of this act the city forester or other officer designated in section one of this act may enter upon private land, and the owners of private land may be taxed for work done under the provisions of section one of this act in the manner provided by sections six and seven of chapter three hundred and eighty-one of the acts of the year nineteen hundred and five and acts in amendment thereof and in addition thereto: *provided, however,* that nothing contained in this act shall require the commonwealth to pay any part of any such expense, other than for the suppression of the gypsy and brown tail moths, that no land shall be assessed under the provisions of this act which has been assessed the maximum amount provided by said sections six and seven and amendments thereof for the suppression of the gypsy and brown tail moths, and that the aggregate assessment on any parcel of private land for the suppression of the tent caterpillar, leopard moth, elm beetle and gypsy and brown tail moths shall not exceed the maximum provided by said sections six and seven and the amendments thereof.

SECTION 3. This act shall take effect upon its passage. [*Approved April 23, 1914.*

KILLING OF DEER.

CHAPTER 453.

AN ACT RELATIVE TO THE TAKING AND KILLING OF DEER.

Be it enacted, etc., as follows:

Section one of chapter five hundred and twenty-nine of the acts of the year nineteen hundred and thirteen is hereby amended by inserting after the word "him", in the eighth line, the words: — or, with the consent of the owner, upon land adjacent thereto, — by striking out the words "found destroying or injuring any fruit tree or any crop", in the ninth and tenth lines, and inserting in place thereof the words: — which he has reasonable cause to believe has damaged or is about to damage crops, fruit or ornamental trees, — and by inserting after the word "destroyed", in the twenty-second line, the words: — or about to be injured or destroyed, — so as to read as follows: — *Section 1.* It shall be unlawful, except as hereinafter provided, to hunt, pursue, wound or kill a deer, or to sell or offer for sale, or to have in possession for the purpose of sale, a deer or the flesh of a deer captured or killed in this commonwealth: *provided,* that this act shall not apply to a tame deer belonging to any person and kept on his own premises; and *provided, further,* that any farmer or other person may, on land owned or occupied by him, or, with the consent of the owner, upon land adjacent thereto pursue, wound or kill any deer which he has reasonable cause to believe has damaged or is about to damage crops, fruit or ornamental trees, except grass growing on uncultivated land; and he may authorize any member of his family, or any person employed by him so to pursue, wound or kill a deer under the circumstances above specified. In the event of the wounding or killing of a deer as aforesaid, it shall be the duty of the person by whom or under whose direction the deer was wounded or killed to mail or otherwise transmit within twenty-four hours thereafter to the commissioners on fisheries and game a report in writing signed by him of the facts relative to the said wounding or killing. The said report shall state the time and place of the wounding or killing, and the kind of tree or crop injured or destroyed, or about to be injured or destroyed, by the deer. It shall be unlawful to sell or offer for sale the whole or any part of a deer killed under the aforesaid provision. [*Approved April 29, 1914.*

POULTRY THIEVING.

Chapter 594.

An Act relative to the detaining of persons for breaking and entering places in which poultry are confined.

Be it enacted, etc., as follows:

Section 1. Whoever, with intent to commit larceny, breaks or enters, or enters in the night without breaking any building or enclosure wherein are kept or confined any kind of poultry, may be detained or kept in custody in a convenient place by the owner of the poultry, or by his agent or employee, for not more than twenty-four hours, Sunday excepted, until a complaint can be made against him for the offence and he be taken upon a warrant issued upon such complaint.

Section 2. Whoever is convicted of such trespassing or breaking or entering shall be punished by a fine of not more than five hundred dollars or by imprisonment in the house of correction for not more than two years.

(*The foregoing was laid before the governor on the twenty-fifth day of May, 1914, and after five days it had "the force of a law", as prescribed by the constitution, as it was not returned by him with his objections within that time.*)

COUNTY FARM BUREAUS.

Chapter 707.

An Act to authorize counties to aid corporations organized to promote agriculture and to improve country life.

Be it enacted, etc., as follows:

Section 1. Any corporation organized under the laws of this commonwealth, not organized for profit and no part of the net income of which shall inure for the benefit of stockholders, having for its corporate purpose the improvement of agriculture and country life, which shall be approved by the Massachusetts Agricultural College and by the county commissioners of the county in which it is located, shall be eligible to receive the county aid herein authorized, but only one such corporation in each county shall be approved for this purpose.

Section 2. Every corporation approved under the provisions of section one shall appoint and maintain one or more advisers in agriculture and country life, who shall be appointed by the advisory board established by section four hereof, and who shall hold office until their successors are appointed and qualified.

Section 3. It shall be the duty of the said advisers to advise and consult with individuals and organizations in reference to farming methods, to assist in the development and improvement of agriculture and of country life, to give instruction in the formation of co-operative enterprises, to promote better business methods among farmers, to assist in promoting more satisfactory methods of marketing farm products, and to perform any other work adapted to promote the agricultural or rural development of that county. It shall be the duty of the advisers to keep in touch with, and to bring to their assistance, all agencies in the commonwealth or elsewhere that will enable them to utilize the latest and best knowledge in the furtherance of their work. The duties of the advisers shall be performed under the supervision and direction of said advisory board, and they shall be subject to such rules and regulations as said board may prescribe.

Section 4. In every county in which a corporation such as that described in section one is organized, there shall be established an advisory board of seven members, consisting of three members to be appointed by the corporation, three by the county commissioners of said county, and one by the six thus chosen. It shall be the duty of the advisory board to superintend and direct the work of the corporation within the county, and it shall have power to appoint, suspend or remove agricultural advisers appointed pursuant to this act.

Section 5. In every such county there shall also be established a finance board, which shall be composed of two members: — one appointed by the county commissioners of said county and one by the said corporation. It shall be the duty of the finance board to certify from time to time, whenever requested so to do by the corporation, to the county treasurer the sums received in the treasury of the corporation in each year, other than the funds appropriated by the county. It shall also be the duty of the said board to consider and report upon the budget of the corporation, as provided in section eight.

Section 6. The power of appointment herein vested in the corporation may be exercised by its executive committee; or if no provision is made in its by-laws for an executive committee, then by its board of directors or other board exercising powers corresponding to those of directors.

Section 7. In every such county, the county commissioners shall include in their annual estimate of county expenses, to be raised by the county by tax levy and appropriated by the general court, such sum as they may deem proper to be contributed to said corporation for the purpose of defraying the expenses of maintaining said adviser or advisers, and of the work carried on by the corporation: *provided, however*, that the sum so contributed shall not be less than one thousand dollars, nor more than the amount raised annually by said corporation from all other sources. The sum so contributed shall be paid to the corporation upon the certificate of the finance board showing that an equal amount has been received in the treasury of the corporation from all other sources; and said sum shall be expended in said county by said corporation for the purposes above named.

SECTION 8. Every corporation of the kind described in section one receiving aid under the provisions of this act shall annually, in the month of December, prepare or cause to be prepared a budget containing a detailed estimate of all sums required to be expended by it for its corporate purposes during the ensuing year, which budget shall forthwith be transmitted to the finance board. The finance board shall estimate what sum may be proper for the corporation to expend during said year for its corporate purposes, and shall submit the estimate, on or before the second Wednesday of the following January, to the county commissioners.

SECTION 9. Any town may, at a legally called town meeting, vote to acquire by purchase or otherwise real estate for the purpose of carrying on, under the direction of the agricultural advisers of the county, agricultural demonstration work within the town, and may appropriate money for the purposes of acquiring such real estate, or for the support of agricultural demonstration work on land owned by the town, or owned by any resident of the town.

SECTION 10. This act shall apply only to the counties of the commonwealth in which a corporation of the class described in section one and approved by the Massachusetts Agricultural College and by the county commissioners has and maintains a principal place of business: *provided*, that counties which maintain county vocational agricultural schools, shall not maintain county-aided corporations for the purposes designated in this act.

SECTION 11. This act shall take effect upon its passage. [*Approved June 25, 1914.*

ACCEPTANCE OF FEDERAL AID FOR EXTENSION WORK.

CHAPTER 721.

AN ACT TO ACCEPT THE GRANTS OF MONEY AUTHORIZED BY CONGRESS FOR THE MORE COMPLETE ENDOWMENT AND SUPPORT OF COLLEGES FOR THE BENEFIT OF AGRICULTURE.

Be it enacted, etc., as follows:

SECTION 1. The commonwealth of Massachusetts hereby assents to the purpose of the advance of money authorized by the act of congress, entitled "An Act to provide for co-operative agricultural extension work between the agricultural colleges in the several states receiving the benefits of an act of congress approved July second, eighteen hundred and sixty-two, and of acts supplementary thereto, and the United States department of agriculture", said act being number ninety-five of the sixty-third congress, and approved on the eighth day of May in the year nineteen hundred and fourteen.

SECTION 2. The commonwealth of Massachusetts hereby accepts the annual grant of moneys made by the United States as set forth and defined in said act of congress, and the treasurer and receiver general is hereby designated to receive the same annually, to be applied by him under and for the purposes of said act; and the Massachusetts Agricultural College is hereby authorized to receive said grants of money.

SECTION 3. The governor is hereby authorized and instructed to give due notice hereof to the government of the United States.

SECTION 4. This act shall take effect upon its passage. [*Approved June 29, 1914.*

LICENSES FOR SALE OF MILK.

CHAPTER 744.

AN ACT RELATIVE TO THE PRODUCTION AND SALE OF MILK.

Be it enacted, etc., as follows:

SECTION 1. It shall be unlawful for any producer of milk or dealer in milk to sell or deliver for sale in any city or town in the commonwealth any milk produced or dealt in by him without first obtaining from the board of health of such city or town a permit authorizing such sale or delivery. Said boards of health are hereby authorized to issue such permits after an inspection, satisfactory to them, of the place in which and of the circumstances under which such milk is produced, has been made by them or by their authorized agent. Any permit so granted may contain such reasonable conditions as said board may think suitable for protecting the public health and may be revoked for failure to comply with any of such conditions. No charge shall be made to the producer for the permit or for the inspection of the dairy where the milk is produced.

SECTION 2. In case any permit so granted is revoked, the board revoking the permit shall immediately send notice of the revocation to the state board of health, and the state board of health shall at once inform the boards of health of other cities and towns in the commonwealth where, in its judgment, milk produced by the dairy to which the permit relates would be likely to be sold or delivered for sale, and the state board of health shall also give notice of such revocation to any dealer in milk who, in the judgment of the board, would be likely to purchase milk from such dairy; and upon receipt of such notice it shall be unlawful for any dealer so notified to sell or offer for sale in this commonwealth milk from the said dairy.

SECTION 3. After a permit has been revoked, it may be renewed in the same way in which the original permit was issued, in which case the same form of notification shall follow as is required in the issuance of the original permit.

SECTION 4. Any person, firm or corporation violating any provision of this act shall be punished by a fine of not more than one hundred dollars for each offence.

SECTION 5. It shall be the duty of the state board of health to enforce the provisions of section two of this act.

SECTION 6. It shall be the duty of the inspectors of milk appointed by the boards of health of cities and towns to enforce the provisions of section one, so far as relates to the milk supply of their respective cities and towns. [*Approved July 3, 1914.*

THIRTEENTH ANNUAL REPORT

OF THE

STATE NURSERY INSPECTOR.

PRESENTED TO THE BOARD AND ACCEPTED,
JANUARY 13, 1915.

THIRTEENTH ANNUAL REPORT OF THE STATE NURSERY INSPECTOR.

To the State Board of Agriculture.

I have the honor to submit herewith the thirteenth annual report of the State Nursery Inspector.

Nursery inspection and the duties connected with it are very unequally distributed during the calendar year. During January, February and a part of March there is usually only work enough for one inspector. About the middle of March import shipments of nursery stock begin to appear, and these rapidly increase until by the middle of April the entire time of three or more men is generally needed. These shipments continue until about the first of June, falling off somewhat in number toward the end of this period. About the first of May, however, inspection for the blister rust on white pines must begin, as the presence of this disease first becomes evident by the formation of fruiting bodies on the outside of the trunk at this time. Inspection for this disease can successfully be continued until about the first of July, at which time all certificates expire, and those places making continuous sales of nursery stock at all periods of the year require immediate inspection in order that there may not be any interference with their business.

By the time these inspections have been completed, inspection of the growing stock in the other nurseries must be begun if this work is to be completed before the fall shipping season begins, and the full force of inspectors is therefore busy on this work until near the middle of September. By this time imports have again begun to come in, and these are received in rapidly increasing quantities through September, October and November, but decrease thereafter to practically none by the latter part of December.

The largest amount of work, therefore, is from about the middle of July to the middle of September. Work requiring from four to ten men must be done from April to July and from the end of September to the middle of December, and during the other three months one man is usually sufficient.

To meet these varying requirements is a difficult matter. Inspection, to be worth anything, must be done by trained men, familiar with the various diseases and with insect pests liable to be met. In addition, those inspectors who examine imported stock should have some knowledge of the foreign pests and diseases liable to be brought in on that class of stock; and if they are to be also available for the blister-rust inspection, they must be familiar with the symptoms of that disease.

If such men could be sure of continuous employment throughout the year at a reasonable compensation, there would be less difficulty in obtaining them; but where they can expect work for a period of perhaps only three or four months at a time, with no certainty when their services will next be needed, it is evident that the inspection service can hardly expect to retain them very long in competition with positions elsewhere paying as well and giving continuous occupation. Then, too, such men must have had special training in entomology and plant pathology as a foundation for their inspection work, and such men are in demand to fill permanent positions at good salaries.

The result is that we have a very limited class upon which to draw for inspectors, — men who are still engaged in fitting themselves to become specialists in entomology or plant pathology, and who, needing some income, are willing to interrupt their studies for brief periods because of the money they will receive for the work. The consequence of this is that when a man has worked at such intervals on the inspection for a year or two, and has acquired experience in this line, he generally completes his training, is offered a permanent position at a good salary somewhere, and is thus lost to the inspection; and new men having training but no experience in actual inspection have to be broken in.

Inspection of Growing Stock.

Inspection of the growing stock in nurseries in 1914 began the first of July and continued until about the end of September, ten men being required for this work. One hundred and sixty nurseries, having 148 owners, were inspected, and 145 certificates were issued, 3 being refused certificates as their stock was in such bad condition that no sales could be permitted.

The conditions found in the different nurseries in the course of these inspections varied greatly, as was to be expected. The last few years, however, have shown marked improvement over previous ones, and the present year was no exception in this regard. The nurseryman who is a good business man quickly learns that he cannot allow his stock to be in anything but good condition, and accordingly finds that it pays to keep his nursery well cultivated, well sprayed, well arranged and well supervised. A nursery of any size if not well kept indicates poor management, probably a poor financial rating, and that it will probably either pass into other hands or become a dead loss.

The nurserymen who are awake to the situation realize this themselves, and, as a result, the inspectors in such places need not spend much time searching for the noticeable pests and diseases, for these will have already been taken care of by the nurseryman himself. There are many places, however, where nursery stock is really only a side issue, the main occupation of the owner being that of a florist, who carries a little stock because his patrons occasionally ask for it. Places such as these are always small, generally neglected, and the stock present is in poor shape and causes much trouble for the inspector. At the present time these places appear to be becoming fewer in number than was formerly the case, and the sooner they are entirely eliminated the better for the people who buy, for it is at least too generally true that after all plants with pests and diseases have been removed, those which remain are poor and of low grade, hardly fit for sale.

To estimate the size of the different nurseries is a difficult task. Some nurseries have their stock planted closely and with few unoccupied areas; others have many gaps in the rows, and parts of the blocks are entirely free from stock. Therefore acreage for the nursery and acreage of the stock are two wholly different things, as in many cases a single acre of land may contain twice as much stock as two or three acres elsewhere. An attempt has been made, however, to estimate the acreage of stock found by the inspectors this year, and though undoubtedly inaccurate, it is certain that over 1,900 acres of nursery stock were grown in 1914 in Massachusetts.

Agents.

Agents for the sale of nursery stock are required by law to hold licenses issued by the State Nursery Inspector, and good for one year from date of issue. The importance of this requirement has been repeatedly shown by the actions of certain of these agents, some of whom are entirely irresponsible, and who take orders, showing attractive pictures of the plants, and then fill these orders by purchasing stock wherever it can be bought most cheaply. Oftentimes the plants obtained in this way are of little value, and frequently not true to name, and any attempt to obtain redress reveals that the agent has disappeared.

The object of this part of the law is to check irresponsible agents as far as possible, and, by keeping track of the sources from which they purchase their stock, prevent the unloading of worthless plants upon their customers. As no charge is made for the license, no burden is imposed, and the reliability and trustworthiness of the agents should be increased. How far these objects have been accomplished is at present uncertain. The law provides a penalty for selling without a license, but as many persons take up the business as a temporary one, unaware that any requirements exist, and leave it for something else after a short time, the inspector is frequently not aware that persons are taking orders without licenses.

In spite of this difficulty in enforcing the law, many applications for licenses are received, and one hundred and thirty-seven such were issued during 1914.

Interstate Shipments.

Many thousand shipments of nursery stock from other States are received in Massachusetts each year, and these should be examined on arrival here in order to be certain that the plants are such as should be allowed to enter the State. A single complaisant official somewhere, willing for any reason to overlook diseased or infested stock, can easily nullify the most rigorous laws, and permit the transportation of worthless stock in all directions, the sole check possible being the examination of all stock at its point of destination. Inspectors too often care far more about the condition of stock entering the State than about that leaving it. The inspectors in this State have tried to examine as much of the stock coming in as possible, but the greater part of it comes just at the time when every one is rushed to the limit to inspect imports. Accordingly only occasional examination of interstate shipments has been possible. This is unfortunate, but the situation cannot be improved until larger appropriations are available, so that more inspectors can be employed. Till then, we must learn of the condition of such shipments only by occasional inspections, regarding these as samples of what we are receiving.

That poor stock may be received in this way is shown by the fact, already stated in a previous report, that one fall eleven of the first thirteen shipments examined from a given State were rejected as unfit to enter Massachusetts. Later shipments that year from that State were satisfactory. Further comment is unnecessary.

Imported Stock.

Every large area has its own native insect pests and plant diseases. These are not in most cases confined to their native territory because they cannot live elsewhere, but because they have been unable to make their way to other suitable places, or to find the proper food on arriving there. Formerly, the establishment of an insect pest in a region far distant from its native habitat was difficult, as its transportation consumed so much time that the insect either died unchanged while on the way, or was transformed into the next succeeding stage of its development, and thereupon found conditions so unfavorable to its existence in its new form that death followed the change. Formerly, in the days of sailing vessels, insects might, for example, be present in their larval or "borer" stage in logs taken on such a vessel in some European port. The long voyage, however, might result in their transforming into adults before reaching the end of the journey, and they would die without having found a place to deposit their eggs. At the present time such a voyage would probably be completed and the logs delivered before any such transformation would occur; and all that would be necessary upon the emergence of the adults would be for them to find trees of some suitable kind growing in the vicinity, upon which to lay their eggs.

With improved transportation facilities, including more vessels, traveling more rapidly than was formerly the case, opportunities for the introduction of foreign pests into this country have increased, and it has been estimated that about seventy-five of the worst one hundred pests now known in the United States are of foreign origin. Importing large quantities of nursery stock has greatly increased the chances for insects to come here, as many present on the plants when taken for shipment would remain on them, and not only reach this country quickly but after arrival find themselves on the very kinds of plants they fed upon in the country from which they came.

Laws intended to prevent undesirable human immigrants from entering the United States have been in force for years; but a similar attitude toward undesirable insect pests and plant diseases has existed only for a very short time, though the losses caused by these injurious immigrants have already run into billions of dollars. If all the pests of other lands had already reached this country, such laws would be unnecessary, but as there are still many very destructive forms which have not as yet reached us, the inspection of all imported nursery stock is not only desirable but of prime importance.

Massachusetts ranks fourth in the amount of nursery stock imported from abroad, and inspection of this is therefore particularly important if we are to escape adding others to the already too long list of enemies of our crops and other plants.

During the year 1914, 724 shipments of imported nursery stock, comprising 5,229 cases, were received in the State and inspected, the source and number of these being indicated by the following list. How many separate plants were inspected it would be impossible to say, as a case may contain anywhere from one to ten thousand or more, according to their size and the size of the case.

Imported Nursery Stock, 1914.

Country.	Number of Shipments.	Number of Cases.
Holland,	250	2,212
Belgium,	207	1,962
England,	95	315
France,	55	224
Scotland,	30	35
Italy,	19	19
Ireland,	17	38
Germany,	17	23
Japan,	11	20
Brazil,	4	53
Columbia,	3	15
Nova Scotia,	3	3
Denmark,	2	22
Cuba,	2	275
Azores,	2	2
Venezuela,	1	4
Jamaica,	1	2
Austria,	1	1
Bermuda,	1	1
Costa Rica,	1	1
Prince Edward Island,	1	1
Trinidad,	1	1
Total,	724	5,229

As the year 1914 was not quite ended when these figures were prepared, the final numbers will probably be slightly greater.

All insects and diseases found, if not recognized by the inspectors, have been sent to the Agricultural Experiment Station at Amherst for identification; and in cases where they were unable to make these identifications, the specimens have been sent to the United States Department of Agriculture for the same purpose. The assistance received from these sources has been very great and is much appreciated.

The insects and plant diseases found on the above list of shipments are as follows: —

Insects.

Times reported.	Name.	Found on —	Country.
16	Lepidosaphes ulmi (L.), . . .	Apple, Box, Cornus, Japanese Maple, Lilac.	Nova Scotia, England, Holland.
6	Aspidiotus hederæ (Vall.), . .	Box, Bay, Orchids, .	England, Belgium, Brazil, Columbia.
11	Aspidiotus brittanicus Newst, . .	Bay, ...	Belgium, Holland.
2	Chrysomphalus aonidum (L.), .	Kentia, ...	Belgium.
3	Chrysomphalus dictyospermi (Morg.),	Palms, ...	Belgium.
19	Coccus hesperidum (L.), . . .	Bay, Palms, Ardisia, Citrus.	Belgium, Holland.
2	"Lecanium" (immature), . .	Bay, Ligustrum, . .	Belgium, France.
2	Aleyrodes (larvæ and molt skins), .	Azalea, miscellaneous, .	Belgium.
2	Psylla buxi (L.), ...	Box, ...	Holland.
1	Heliothrips hæmorrhoidalis (Bouche),	Azalea, ...	Belgium.
1	Stenus sp., ...	Miscellaneous, . .	Holland.
1	Tenebrioides mauritanica (L.), .	Miscellaneous, . .	Holland.
1	Elaterid larva, ...	Pinus mughus, . .	Holland.
1	Diprion pini (L.) (cocoons), . .	Abies concolor, . .	Holland.
1	Bombus terrestris (L.), . . .	Buxus, ...	Holland.
1	Ants, ...	Calluma, . . .	Holland.
1	Hemiteles areator Grav., . . .	Rose, ...	Holland.
1	Cnidocampa flavescens (Walk.) (cocoon.)	Wistaria, . . .	Japan.
8	Notolophus antiqua (L.) (eggs), .	Rose, Apple, Laurus, .	Belgium, Holland, Denmark.
1	Dasychira perdibunda (L.), . .	Thuya globosa, . .	Holland.
17	Peronea schalleriana (L.) (larvæ; pupæ.)	Azalea, miscellaneous, .	Belgium.
22	Gracillaria azaleæ Busck (larvæ), .	Azalea, ...	Belgium.
1	Monarthropalpus buxi Lab., . .	Box, ...	England.
2	Phytomyza aquifolii Duf., . .	Holly, ...	Holland.
5	Ero sp. (spider eggs), . . .	Box, Palms, . . .	Belgium, Holland.
1	Crustacean ("sow bug"), . .	Azalea, ...	St. Croix.
1	Milleped, ...	Azalea, ...	St. Croix.
1	Snail, ...	Roses, ...	Holland.

Insects not yet determined.

Times reported.	Name.	Found on —	Country.
1	Parasite of Notolophus eggs,	Rose,	Holland.
1	Pupa,	Mahonia,	Holland.
6	Cocoons,	Azalea,	Belgium.
1	Parasites on Diprion pini,	- -	Holland.
1	Dipterous pupa,	Azalea,	Belgium.
23	Broken parts, or imperfect specimens impossible to identify.	- -	- -

Diseases.

Times reported.	Name.	Found on —	Country.
1	Leptosphæria sp.,	Wistaria,	Japan.
23	Bacterium tumefaciens,	On ten kinds of plants,	England, France, Holland, Germany.
1	Undetermined disease,	Cherry,	Japan.
1	Micorrhiza sp.,	Hippophæ rhammoides,	France.
1	Fusarium,	Abies concolor,	Holland.
1	Mold sp.,	Roses,	Holland.
1	Sooty mold,	Bay,	Belgium.
1	Anthracnose,	Rose,	Nova Scotia.
2	Exobasidium azaleæ,	Azalea,	Belgium.

Of course all the insects and diseases found are removed, or where this is impossible, the infested or infected stock is destroyed. A few in the above list have been received so recently that their identity has not yet been ascertained.

The Pine Blister Rust.

This very serious disease of the five-leaved pines has been present in this country for several years. It probably reached Massachusetts between 1900 and 1905, presumably on nursery stock, either directly from Europe or through some other State, and established itself in several places. It was not generally recognized in this country at first, and its seriousness was not realized until about 1910, when a general investigation to locate cases of the disease was begun. In 1911 and the spring of the following year, so many cases of this disease were found on imported pines at the time they reached this State that it seemed wise to issue an order which would prevent their introduction, and this was accordingly done, so that no new cases can now be brought into Massachusetts.

If this disease ever gets established in our forests, the attempt at the reforestation of our wild lands, which is now an attractive proposition, may as well be abandoned, and it has seemed wise to take every possible precaution to prevent this. With no new stock liable to have the disease, coming in, the problem restricts itself to the discovery and elimination of all cases already present in the State. This is best accomplished during the months of May and June, when the trouble is most evident to the eye, on the pines, and during August, September and October, when it shows on currants; for this peculiar disease, after living in the pine for a greater or less number of years, finally breaks through from the inside, and on the surface of the bark produces its spores, which pass to the currants and there produce another stage in the leaves. In the fall this stage in its turn produces spores, and, if these pass to pines, they infect the trees.

From this it follows that pines may have the disease for several years before it shows, though usually traces of it are evident. When the spores are forming on the bark in the spring, however, the trouble is easily recognized. Currants examined in the fall also show the disease if it is present, and by an inspection of both of these kinds of plants the trouble can be positively located.

All white pines and other five-leaved pines received by nurseries in Massachusetts have been carefully inspected now for several years, and all sales from infected blocks stopped. Some sales, however, were made before any knowledge of the disease was available, and, as far as possible, all of these trees have been traced and inspected where they now are. Whole blocks of nursery trees not showing any evidence of the disease have been destroyed, simply because one or two in the block were affected, at a loss of thousands of dollars to the nurserymen;

and it is believed at the present time the action has been so radical and thorough that not a case exists in a single nursery in the State, though spring inspection of the pines in the nurseries will continue until belief becomes absolute certainty.

Many lots of pines, however, have passed either from the nurseries or directly from abroad into private hands, which for the protection of our pine forests has rendered necessary the inspection of a great many plantings on different estates in various parts of the State. The source from which these trees came has been carefully considered, and spring inspection of the pines has been given for three years, followed by fall inspection of currants, seeking for evidence from them of the presence of the blister rust. All diseased pines and all infected currants found have been destroyed, and as far as possible the two kinds of plants have not been permitted to grow within contagious distance of each other. If no currants are near enough to the pines to take the disease, they will, of course, be unable to transfer it to other pines; and only those trees already infected will suffer, for the disease cannot spread from pine to pine, but only from pine to currant and the reverse.

The situation at the present time is distinctly encouraging. Owners of estates where the blister rust is present are doing everything in their power to co-operate with the inspectors and eliminate the disease, and currants near pines are being removed. The main thing now needed is to continue the inspection until all the cases of the disease are discovered as they appear; to destroy those trees, watching any currants in the vicinity, later in the year; and to make sure by the absence of disease then that no undiscovered cases on the pines exist.

The curious relation between pine and currant with this disease makes its complete extermination possible, though the slowness with which the disease appears on the pine in some cases requires continued inspection. The enforced separation of pines from currants is an effective check, and persistence in the work for a few years more should mean the extermination of the disease in the State. The inspector believes that if this work can be continued along its present lines, no cases of the disease should be found after 1917 and perhaps before that time. Some places are already entirely cleared and many more will be next spring. The greater part of the trouble is in a restricted area in one county, and every suspicious place, with three exceptions, has now been thoroughly gone over for several years. If the rust can be exterminated, it will mean the safety of the millions of pines now growing in Massachusetts and the further reforestation of the State, so much to be desired.

DISTRICTS.

For convenience in the inspection work, the State has been divided into two districts, one including the western part of the State as far east as Worcester County, the other including the remainder.

The chief inspector has personally supervised and directed the work in the western district, from his office at Amherst, and by correspondence and frequent personal visits has kept closely in touch with the conditions and work in the eastern district, which has been under the immediate charge of Chief Deputy R. H. Allen, whose office has been at Room 136, State House, Boston.

During August the chief inspector located in Boston and took charge of the eastern district, and put himself thoroughly in touch with the conditions there, devoting his entire time to that part of the work, personally examining a great many of the places where conditions required particular study.

Correspondence has been quite large in amount, rather more than 2,500 letters having been sent out from the two offices during the year.

FINANCIAL STATEMENT.

Appropriation,		$15,000 00
Compensation of inspectors,	$5,404 78	
Traveling and necessary expenses,	5,080 30	
Supplies (postage, printing, etc.),	206 13	
Clerical services,	204 25	
Salary, chief inspector,	500 00	
		11,395 46
Balance,		$3,604 54

Acknowledgment should be made here of the great assistance which has been received in the course of the year's work from the secretary of the Board, who has in many ways shown his appreciation of the many difficult problems which have arisen, and who by his advice has aided in their solution. The faithful work of the chief deputy, Mr. R. H. Allen, deserves the highest commendation, and the interest shown by the Massachusetts Forestry Association has been most encouraging and helpful in many ways.

A list of the nurserymen of Massachusetts, together with the estimated acreage of each, is presented as an appendix.

Respectfully submitted,

H. T. FERNALD,
State Nursery Inspector.

AMHERST, MASSACHUSETTS.

APPENDIX.

LIST OF NURSERYMEN IN MASSACHUSETTS, JAN. 1, 1915.

[Asterisk (*) means less than 1 acre.]

NAME AND ADDRESS.	Estimated Number of Acres.
Adams, J. W., Springfield,	70
American Forestry Company, Framingham,	75
Anderson, William, Lakeville,	4
Arnold Arboretum, Forest Hills,	*
Atkins, P. A., Pleasant Lake,	1
Atwater, C. W., Agawam,	12
B. & M. Nurseries, South Lawrence and Lowell Junction,	5
Bailey, L. W., West Newbury,	*
Barker, L. W., Hanson,	*
Barr, George L., Worcester,	*
Barrett, M. W., Hyde Park,	1
Barrows, H. E., Brockton,	1
Bay State Nurseries, North Abington and Rockland,	225
Bemis, A. L., Worcester,	3
Bowen, W. B., Whitman,	*
Brandley, James, Walpole,	5
Breck-Robinson, Lexington,	100
Breed, E. W., Clinton and South Lancaster,	10
Briggs, L. H., Smith's Ferry,	*
Brightman, William, Westport,	2[1]
Brown, John A., Concord,	1
Canning, E. J., Northampton,	8
Carr, Charles, Dighton,	3
Casey, C., Melrose,	*
Chaffee Brothers, Oxford,	*
Chase, Henry, North Spencer,	*
Cherry Hill Nurseries, West Newbury,	60
Clapp, E. B., Dorchester,	*
Clark, G. A., Waltham Highlands,	1½
Colpritt, E. S., Arlington,	*
Continental Nurseries, Franklin,	10
Coskery, Elmer, Newburyport,	*
Cutler, Mary, Holliston,	10
Davenport, A. M., Watertown,	*
Dighton Nursery Company, Dighton,	5
Dove, Paul, Wellesley,	2
Draper, James E., Worcester and Shrewsbury,	7
Dwyer, E. F., & Son, Lynn,	*
Eager, G. B., Wakefield,	*
Eastern Nurseries, Holliston,	60
Elliott, W. H., Brighton,	–[2]
Farquhar, R. & J., Sharon Heights, West Barnstable and Dedham,	240
Faunce Experimental Farm, Sandwich,	*
Ford, J. P., East Weymouth,	*
Framingham Nurseries, South Framingham,	225
Franklin Field Nurseries, Boston,	3
Franklin Forestry Company, Colrain,	5
Frazer, William R., Northboro,	1
Frost, J. Howard, West Newton,	9

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[1] Small fruits.

[2] Greenhouse stock.

Name and Address.	Estimated Number of Acres.
Gallivan Brothers, Smith's Ferry,	*
Gates, W. A., Needham,	10
Gilbert, A. L., Springfield,	10
Gordon, A. B., Randolph,	*
Gowing, J. D., North Reading,	3[1]
Gray, M. F., Mattapan,	*
Greaton, C. H., Abbott Run Station,	*
Gregory, J. J. H., & Son, Middleton,	2[1]
Haendler, Max, South Natick,	16
Hallen, C. E., East Dedham,	1
Hamlin, N. B., Ponkapog,	*
Heurlin, Julius, Braintree,	20
Hitchcock, E. M., Agawam,	15[1]
Horne, H. J., & Co., Haverhill and Merrimack,	7
Howard, J. W., Somerville and Woburn,	1
Huebner, H., Groton,	5
Hughson, L. T., Dorchester,	1
Horticultural Company, Worcester,	1
Jack, J. G., East Walpole,	*
Jahn, H. A., New Bedford,	*
Jennison, W. C., Natick,	*
Kakihara, Mrs. H., South Lowell,	3
Kameyama & Serada, North Cambridge,	*
Keene, C. R., Cohasset,	*
Keizer, H. B., Reading,	4
Kelsey, Harlan P., Boxford,	70
Kempton, Clifford, Longmeadow,	9½[1]
King, B. F., Tewksbury,	5[1]
King, R. B., Nantucket,	*
Kirkpatrick, George S., Winchester,	2½
Lamke, H. J., Richmond,	*
Lawrence, H. V., Falmouth,	*
Leuthy, A., Roslindale,	–[2]
Littlefield & Wyman, North Abington,	*
MacGregor, James, Braintree,	*
Mann, W. H., Stoughton,	*
Manning, J. W., North Wilmington,	50
Margeson, I. I., Westwood,	*
Mauersberger, R. B., Pittsfield,	*
McCormack, J. J., Malden,	*
McLaren, A., Westwood,	*
McMannon, J. J., Dracut,	25
McMulkin, E., Norfolk Downs,	*
Merritt, Charles, South Weymouth,	*
Miller, W., & Sons, Lynn,	*
Murray, Peter, Fairhaven,	*
New England Nurseries, Bedford,	141
Newell, C. F., West Newbury,	*
North Shore Fernery Company, Beverly,	–[2]
North Shore Nursery Company, Beverly Farms,	1
Oak Hill Nursery, Wadsworth,	1
Old Colony Nurseries, Plymouth,	25
Oxford Nursery Company, Oxford,	*
Paillet, August, Montague,	*
Palmer, F. E., Brookline and Newton,	3
Parker, James G., Concord,	1
Pease, Charles, Salem,	*
Peckham-Whitney Company, Fairhaven,	*
Phelps, F. H., Lee,	8
Pierce, Charles, Dighton,	1[3]
Pomeroy, Edward A., Gloucester,	*
Post & Gray, New Bedford,	*
Pratt, C. S., Reading,	17[1]
Pratt, H. C., North Orange,	7
Price, R. T., Lawrence,	*
Pulsifer, C. Y., Gloucester,	3

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[1] Small fruits.
[2] Greenhouse stock.
[3] Two acres small fruit.

Name and Address.	Estimated Number of Acres.
Quinn, James, Brookline,	*
Rea, F. J., Norwood Central,	4
Richards, E. A., Greenfield,	*
Riley, Charles N., New Bedford,	*
Robbins, Henry W., Littleton,	*
Robin Hill Nursery, Chelmsford,	18
Robinson's Sons, D., Everett,	*
Robinson, L. D., Springfield,	*
Sawyer, F. P., Clinton,	*
Shaw, F. H., Rockland,	*
Sinclair, G. H., Smith's Ferry,	*
Smith, George N., Wellesley Hills,	6
Southwick Nurseries, Southwick,	40
Southworth Brothers, Beverly,	30
Spinney, F. W., Haverhill,	20
State Forestry Department, Barnstable, East Sandwich and Amherst,	14½
Stearns, L. C., Bridgewater,	1
Story, A. T., Taunton,	5
Sylvester, G. F., South Hanover,	3
Sylvia, M. B., New Bedford,	2
Tebbetts, C. H., East Walpole,	2
Turner Hill Farm, Ipswich,	4
Tuttle, A. M., Melrose Highlands,	20
Walsh, M. H., Woods Hole,	8
Walters, C., North Stoughton,	*
Ward, Ralph, Beverly,	*
Warren, Mrs. Samuel, Weston,	1[1]
West Side Nurseries, Worcester and Auburn,	75
Wheeler, Wilfrid, Concord,	*
Whitcomb, F. W., Holbrook,	*
White, A. T., New Bedford,	2
Winchendon Nurseries, Winchendon,	1
Yetter, F. J., Greenfield,	*

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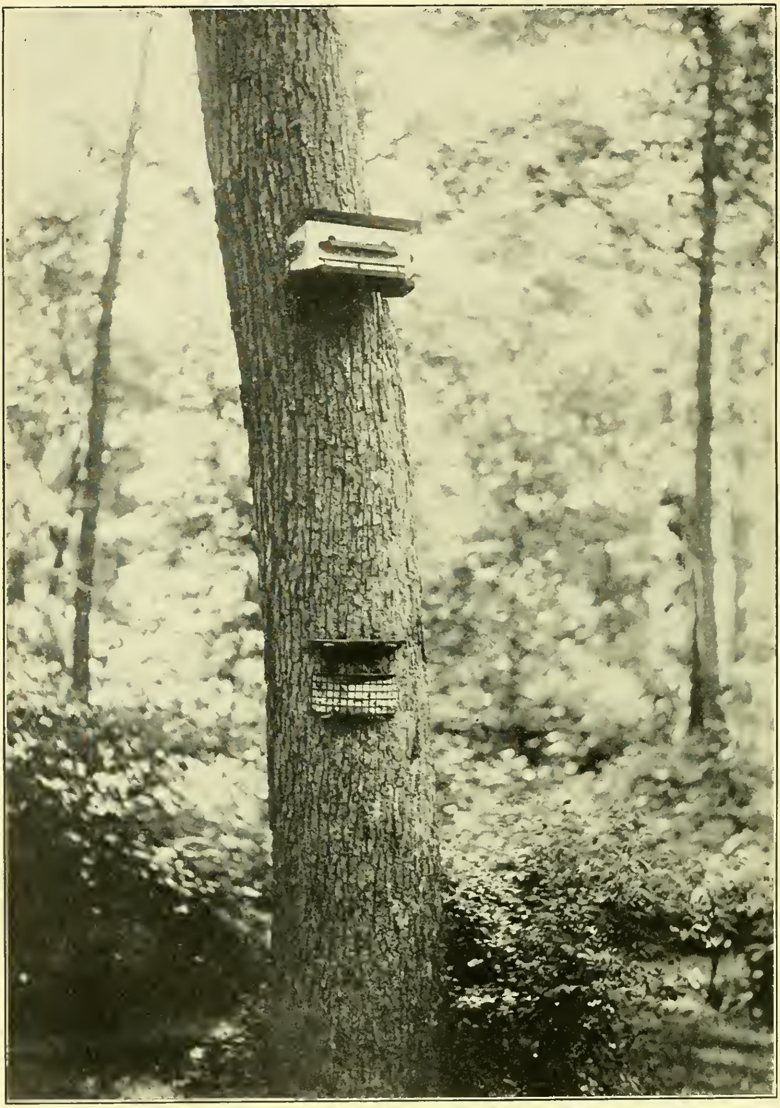
[1] Small fruits.

SEVENTH ANNUAL REPORT

OF THE

STATE ORNITHOLOGIST.

Presented to the Board and Accepted,
January 13, 1915.



Hospitality for both summer and winter birds on the same tree. Charles E. White of Kenilworth, Illinois, inventor of a suet basket for birds, puts one of the baskets and a wren bungalow on the same tree. There is but one entrance for the birds in the bungalow; the others are blinds. (Photograph by Charles E. White.)

SEVENTH ANNUAL REPORT OF THE STATE ORNITHOLOGIST.

To the Honorable Massachusetts State Board of Agriculture.

Some socialist has said that government is a system by which money is taken away from one class of people and given to another. However much or little truth there may be in this saying, it is a fact that bird laws have been so made in the past that birds which should have been protected for the benefit of agriculture and forestry have been exploited for the benefit of commercial interests much to the detriment of agriculture. Any attempt to secure legislation to protect birds, which is likely to interfere with the profit of any trade or business, is met with desperate organized opposition. Whenever a movement is made to secure needed protection to save birds from extinction, organizations of feather dealers, marketmen, or some other interest that receives a profit from the killing and sale of birds is aroused to furious opposition at the prospect of the loss of a money-making privilege. Such interests will spend money liberally to defeat legislation for the protection of birds. Hence it becomes necessary not only to impress upon legislators the necessity for such enactments, but also to arouse their constituents until they realize the danger that threatens the birds and the necessity for bird conservation. Therefore, all successful attempts to secure legislation for bird protection must be preceded or accompanied by much educational work.

LEGISLATIVE AND EDUCATIONAL WORK.

The law under which the office of the State Ornithologist was established in Massachusetts (chapter 245, Acts of 1912) provides that the incumbent shall act in an advisory capacity in matters regarding legislation for the protection of birds. In the first years of my incumbency, my advice was rather too freely offered to the Legislature. Nevertheless, most of the measures recommended have since been enacted into law in Massachusetts and several other States.

Effective bird protection cannot stop at State lines, and therefore efforts have been directed toward the enactment of Federal legislation. In my last annual report (1913) a brief account was given of the final enactment of the McLean-Weeks' law for the protection of migratory birds and the passage of the plumage amendment to the tariff bill. It was asserted in that report that all that had been accomplished was a mere beginning, and that a fight would have to be made to retain this legislation on the statute books and secure appropriations for the enforcement of the Federal law. This prediction has been verified. No sooner was the McLean-Weeks' bill passed, and the regulations under it promulgated, than a movement was begun to organize spring shooters, market hunters, game dealers, saloon and restaurant keepers, and other interests that thrive in a commercial way by the slaughter of game, with the following objects in view: (1) to support people in breaking and defying the law for the protection of migratory birds; (2) to test the constitutionality of the law; (3) to defeat appropriations for its enforcement. These associations were formed chiefly in the middle west and south. They raised considerable sums of money for carrying out their purposes and already have secured some results. The motive which underlies all this opposition is not far to seek.

A man named Hardy, who buys birds from the gunners of Arkansas, is credited by Arthur D. Holthaus, deputy game commissioner of Missouri, with the assertion that he made $1,800 in one day in buying and selling wild fowl, and that his profits were never less than $100 a day as long as the stream of birds slaughtered by wholesale continued.[1]

On May 28, 1914, Judge Trieber, in the United States District Court, at Little Rock, Arkansas, rendered an opinion adverse to the Federal law, but in other cases the law has been upheld and the fines paid. The test case, however, will be brought before the United States Supreme Court probably some time in 1915.

Strong concerted efforts were made to prevent any appropriation of money by Congress for the enforcement of the law. In the early part of 1914 the United States Department of Agriculture submitted an estimate for an appropriation of $100,000 to be used in carrying out the provisions of this law. The House reduced this to $50,000. On April 10, while in Washington at the Annual Congress of the American Ornithologists' Union, I learned that the Senate committee on agriculture had voted to strike the entire appropriation from the bill. The influence used to obtain this result was traced directly to the seat of war in the west. The forces of protection were rallied, however, and $50,000, the sum voted by the House of Representatives, was appropriated by the Senate. This sum manifestly is so inadequate that it was impossible in 1914 to secure country-wide enforcement of the regulations for the protection of migratory birds.

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[1] See Bulletin American Game Protective Association, Vol. 2, No. 6, October 15, 1914, page 6.

The inspectors of the Department of Agriculture are given no power to enforce these regulations or even to make arrests; they can only lay information before the district attorneys and leave the enforcement of the law to the Department of Justice. Nevertheless, the law has been respected in many sections of the country, and is believed to have been responsible already for some notable increases in the numbers of certain migratory birds. It is imperative now that the State laws be made to conform to the Federal law as far as is practicable.

Since the tariff prohibition of plumage importation went into operation pressure has been brought to bear on the United States customs authorities to raise the bars in various ways for the admission of plumage from other countries. A ruling has been made allowing women who wear feathers out of the country to wear the same plumage on their return. The extent of the former trade in birds and plumage with the United States may be gathered from an article in the July-August (1914) "Bird Lore." Leo J. Miller, a member of the Roosevelt Brazilian expedition, asserts that in one place he saw piles of bales of rhea feathers aggregating 60 tons in weight which had been gathered for the trade with the United States, but which then could not be legally imported into this country, and he learned that 34 tons of these feathers had been exported during the first six months of 1913. The United States customs authorities finally withdrew the embargo on rhea feathers, on the ground that they were ostrich feathers. When it was shown that the bird was not of the same order, genus, family or species as the ostrich, the ruling was reversed on November 9. Possibly it was in effect long enough to allow the South American dealers to dispose of their stock. This ruling probably will save the rhea from early extinction unless a third ruling, allowing the entry of rhea feathers on presentation of satisfactory evidence that they have been taken from domesticated birds, leaves a loophole that may be taken advantage of by the importers.

On the whole, however, the law has operated satisfactorily. The sales of bird skins and plumage in London during the year 1914 were failures; prices ruled very low, and a large part of the skins offered could not be sold at any price. In this country manufactured ornaments have been used largely to take the place of feathers.

The passage by the Congress of the United States of the plumage clause in the tariff bill was followed by a new tariff regulation by the Canadian government, in which was incorporated a clause prohibiting the importation of the plumage of wild birds. This provision became effective January 1, 1915. Australia had already adopted a similar provision.

While the plumage fight was still pending in the United States, we were furnishing facts and figures for the English campaign for the passage of a bill to forbid the importation of plumage into the British Isles. James Buckland, the English naturalist, was prominent in the fight for the bill, which went to a third reading in the House of Commons by an overwhelming majority. Pending the passage of the bill which was looked upon as certain, the British government called an international Congress on the plumage question, to meet in London. It was stipulated that each nation sending delegates must be prepared to prohibit the import and export of plumage. Only France, Holland and Denmark, of the European nations, refused to come into the Congress. The British Royal Society for the Protection of Birds received the following from Professor C. G. Schillings, the celebrated German naturalist: —

> The United States has found the only satisfactory solution of this question. We German friends of nature and the birds, convinced too

of the great economic importance of the latter, only wait anxiously that England may also get its feather importation law. *We certainly will follow.*

The International Council of Women, held in Rome on May 10, 1914, pledged itself, by a resolution offered by one of the English delegates, to try to secure legislation in all countries to prevent the destruction of birds for dress ornaments. A movement was started by Mr. Buckland in Holland to pass a plumage bill there. The Hobhouse plumage bill took its second reading in the British House of Commons on May 19, 1914, by a vote of 297 to 15, but was finally defeated by the obstructive, retarding efforts of its opponents, in spite of the Prime Minister's plea on July 23, 1914, that it be allowed to pass by consent. Then, on August 1 came the European war, and soon, with half the world at war, all thoughts of bird protection came to an end. The distraction caused by the war has delayed and may yet defeat the proposed treaty between Great Britain and the United States for the protection of migratory birds, and the antipathies engendered by war may put off for years any understanding among the nations for the mutual protection of birds in any way. Until peace is declared nothing further can be done abroad. Therefore it remains to accomplish in the interim all that is possible here, by educational work, to secure respect for the laws that we have.

During the fight for the plumage bill in England the International Plume Dealers' Association was particularly active. At its international Congress, held in Paris, it passed resolutions urging the repeal of the section of the United States tariff act prohibiting the importation of plumage and the similar legislation in Canada. A determined attempt to modify or repeal these provisions must be expected. A sample of the kind of measures resorted to by the plumage trade is shown in the formation of the economic committee for the protection of birds, which grew and flourished for a time in England while the fight for the plumage bill was on. This committee was organized by the plumage trade and financed by feather dealers, mainly, to defeat the bill. It was the old story over again of the wolf taking care of the sheep. It is even intimated that friends of the birds were influenced to join the movement and to contribute toward it, not fully understanding its import. This organization was what is called a "red herring" in England, and its aims and objects were quickly exposed. Nevertheless, it is supposed to have used effective influence to defeat the Hobhouse bill.

More and more the idea is borne upon me, as the years go by, that the chief work of a State Ornithologist should be educational. The expert economic ornithologists of the Bureau of Biological Survey, of the United States Department of Agriculture, are making an exhaustive study of the food of American birds and publishing the results. It is unnecessary for a State Ornithologist to attempt to duplicate this work, although it may be imperative at times for him to learn how local conditions affect the food of certain birds, or to determine the effect of the feeding of birds on local insect pests. It is his duty to publish the facts regarding birds and their enemies obtained by his own observations, to assist in promulgating the facts obtained by the government experts, to interest the public in the study of useful birds and the means of increasing their numbers, and to inform the people how to protect their crops from birds with harmful habits. During the past year the educational work of this office has followed these lines.

The usual free lectures have been delivered; articles regarding means of attracting and protecting birds have been sent to many newspapers; some attention has been paid to the enemies of birds introduced into this country; the bulletin on "Rats and Rat Riddance" has been finished during the year, and is ready for distribution. Material has been gotten together for a bulletin on the economic value of the domestic cat. Both the above animals are persistent, introduced enemies of birds. The rat often attacks the nests and young of birds and is destructive to poultry, while the cat is recognized by all those conversant with the facts to be a dangerous and destructive natural enemy to all small birds and game birds in settled regions. Domestic cats run wild, and have spread over New England, even into the uttermost parts of the Maine woods. These feral cats are not seen often, as they are nocturnal, hiding during

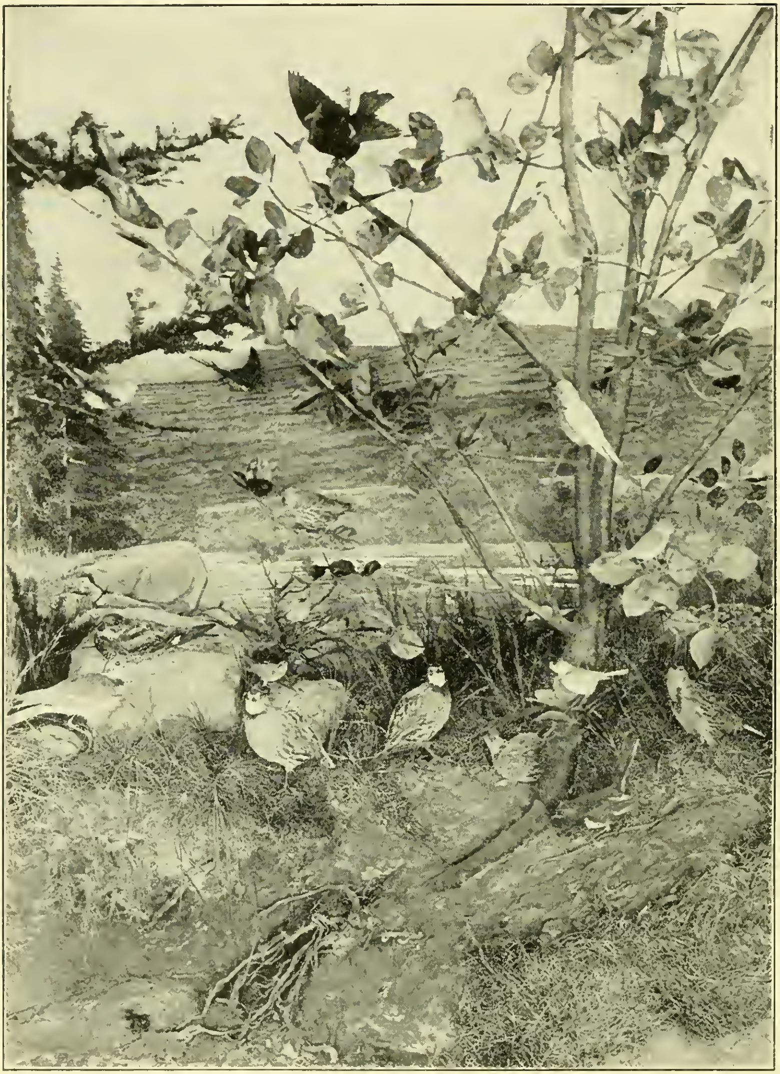


Exhibit of useful birds and their food, prepared by direction of the State Board of Agriculture for the Massachusetts exhibit at the Panama-Pacific Exposition at San Francisco. (Original photograph.) See page 381.

most of the day and coming out at dusk. Half-wild stray cats are more commonly observed, and hundreds of thousands are killed annually in the larger cities by the agents of humane societies, but no attempt has been made to reduce their numbers in the farming country where they are most harmful to bird life.

There is a movement on foot in several States to secure public control and private ownership of the cat by requiring the owner to take out a license for each cat, as licenses for dogs are now required. All these subjects, as well as the means of protecting birds and poultry from cats, will be discussed in the forthcoming bulletin.

Exhibits showing the Economic Value of Birds.

Three exhibits showing birds and their food have been completed during the year under the direction of this office. Two of them consist of elegant large cases for the Crane Museum at Pittsfield enclosing preserved birds and insects, with natural accessories and a background of Massachusetts scenery painted in oils. The suggestion came from Zenas M. Crane, and the two cases represent some of the common birds, insects and plants of Massachusetts in a summer scene, and others in a winter scene. The other exhibit was prepared as a part of the Massachusetts agricultural exhibit at the Panama-Pacific Exposition at San Francisco in 1915, and probably will be returned to the rooms of the Board of Agriculture when the exposition is over. It is somewhat similar to the summer exhibit of the Crane Museum, but smaller. It is illustrated on the opposite page.

Questions.

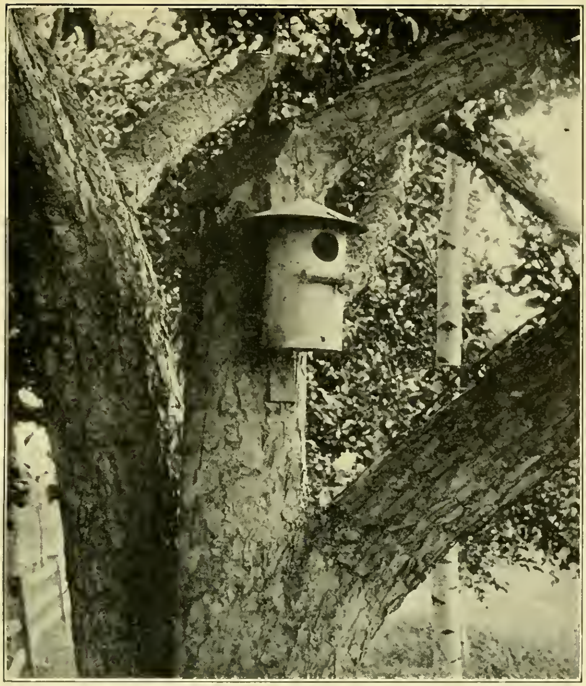
The demand for information about birds from all classes of people constantly increases. Inquiries regarding birds come from many States. This is owing to the general awakening of interest in birds, and to the fact that comparatively few States are provided with official ornithologists. The National Association of Audubon Societies, recognizing the demand for such information, organized in 1914 a department of applied ornithology, to be conducted by the Rev. Herbert K. Job, who resigned the position of State Ornithologist of Connecticut in order to take up the new work. If every State would establish the office of State Ornithologist the pressure on the few might be somewhat relieved. The answering of questions is an important part of the educational work of any State Ornithologist. One could hardly refuse to reply to a question merely because the questioner did not happen to be a citizen of his State. Migratory birds do not stop at State lines. Such birds are "here to-day and there to-morrow," and any information that one can impart to citizens of other States is given freely always, as it may benefit the birds of our own State during their migrations; but the correspondence does not stop even at the limits of our own country. The two volumes published by the State Board of Agriculture, "Useful Birds and Their Protection," and "A History of the Game Birds, Wild Fowl and Shore Birds of Massachusetts and Adjacent States," have gone to other countries. Our work in bird protection here has interested those in other lands, and inquiries have come from Europe, India, China, Australia, Africa and South America. All letters have been answered in full.

This correspondence might form the basis sometime for a book on "what people want to know about birds."

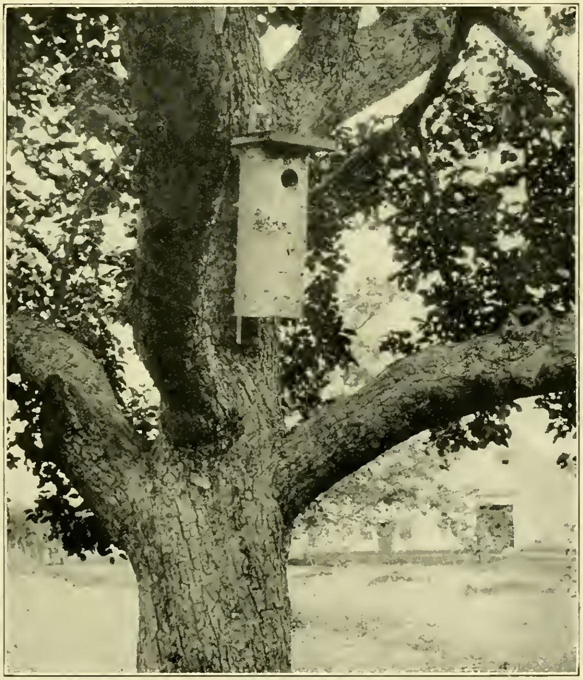
Among the most difficult queries to answer satisfactorily are those requiring the identity of birds from partial or imperfect descriptions of birds seen briefly in the field. Occasionally, even when considerable care is taken to note the shape, color and size of a bird, its identity still remains a conundrum.

The following, with its accompanying illustration, is appended to show a good method of description, and to illustrate the possible difficulties of identifying species even when a good rough description and drawing are given: —

Miss Amelia M. Symmes of Winchester, Massachusetts, writes that three unusual birds were seen in her neighborhood on January 23, 1914, by one of her neighbors. She asked him to write a description of the birds, and he brought her a descriptive drawing of which the cut is a facsimile. He said that the tails were narrow and long, not fan-shaped, and that the crest was very high; also that the birds were about the size of blue jays and did not look so much "like a duck as the drawing."



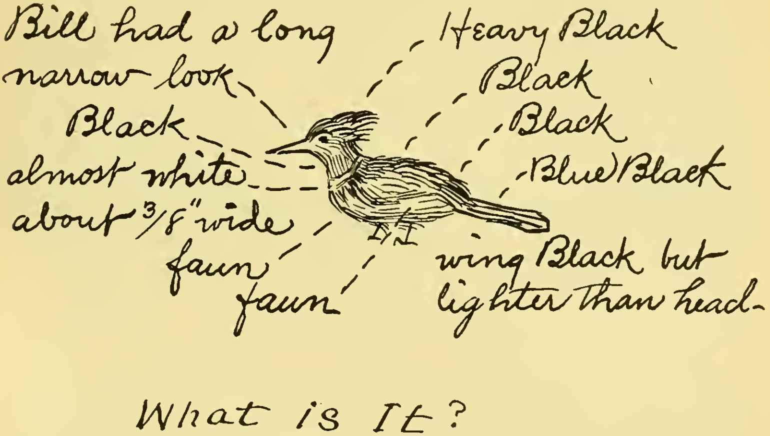
Nesting box made of roofing felt, by Winthrop Packard. (Original photograph taken on farm of William P. Wharton at Groton, Massachusetts.)



Berlepsch nesting box. (Original photograph taken on farm of William P. Wharton.)

They came into the yard after bits of bread which had been put out for other birds, and carried the bread off to some distance to eat it.

The question, "What is it?" is still unanswered. I know of no North American bird that resembles it. Perhaps some friendly ornithologist reading this report may be able to furnish the desired information. If so it will be welcome. If those who desire birds identified will send in a sketch similar to the one shown here, giving shape of bill, head, body, tail and legs, in proper proportions, and place the colors in the proper places, the bird usually can be identified with little trouble, unless it is not a North American species.


Bill had a long narrow look
Black
almost white
about 3/8" wide
faun
faun
Heavy Black
Black
Black
Blue Black
wing Black but lighter than head
What is It?

Facsimile of descriptive drawing of a bird.

Co-operation with Organizations for the Protection of Birds.

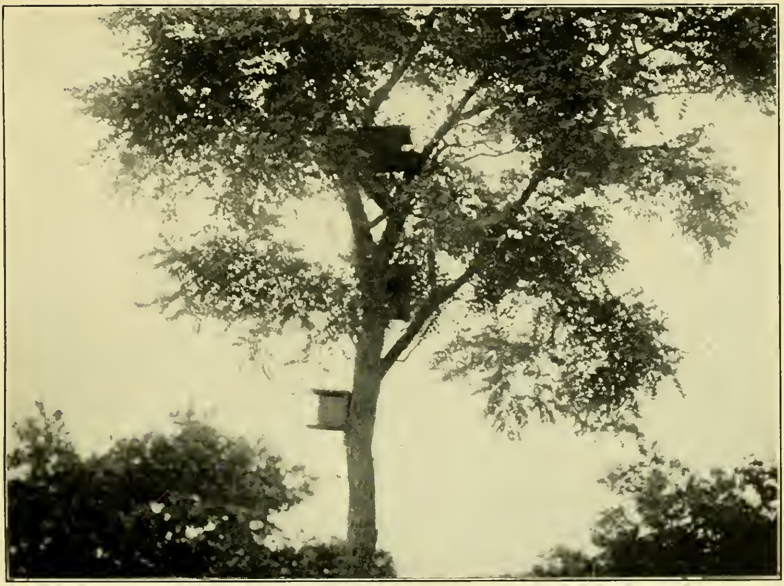
During the past year, as in previous years, efforts have been made to co-operate with all organizations working for the protection of useful birds. Active work has been undertaken with the Massachusetts Audubon Society, the Massachusetts Fish and Game Protective Association, and the Fish and Game Commission, to popularize the work of putting up nesting boxes for the birds. Inexpensive boxes were made after my plans by E. C. Ware of Wareham. Winthrop Packard, secretary and treasurer of the Massachusetts Audubon Society, also prepared some inexpensive nesting boxes. Nearly a thousand of the Ware boxes were put up, and a large percentage of them were occupied by birds.

In co-operation with the Massachusetts State Grange many educational entertainments and illustrated lectures have been given among the rural population during the past few years. At the annual meeting of the State grange at Worcester in 1909 a resolution for the appointment of a committee on wild birds was adopted, and State Master Gardner named a committee, of which C. H. Rice was chairman, and Mrs. Ella Ormsby Marshall, secretary.

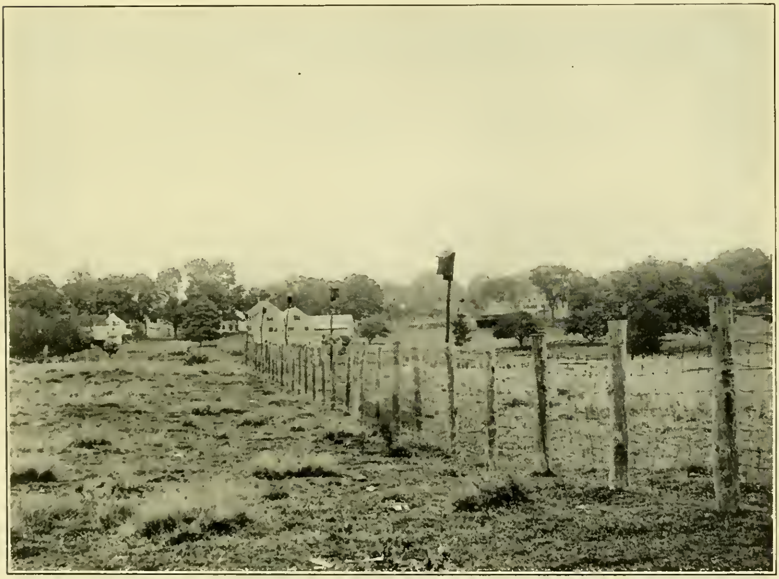
This committee at once began active work, taking a hand in both State and national legislation for the protection of birds, introducing entertaining, instructive bird work into the programs of the subordinate granges, and as time went on and the committee was made permanent and its membership increased, members have given talks on birds in many granges. This work has been seconded and advised from the office of the State Ornithologist. The master of the State grange, Edward E. Chapman, is an active supporter of the committee's work, as was Past Master Gardner, who has published much in favor of bird protection in the official grange paper which circulates very widely.

The following extract from the annual report of Mrs. George S. Ladd of Sturbridge, lecturer of the State grange, plainly shows her attitude toward the movement for bird protection, and gives a brief account of one of the grange activities for the birds in 1914: —

> Massachusetts farm people are noted for their hospitality and whole-heartedness, but they have been neglecting some of their best friends; and I do not believe I am stating it too emphatically when I say some of the best friends the farmers have are the birds, and it is our duty to protect and encourage them. Studying expenditures in our State I find we have been spending immense sums of money to destroy the injurious insects and allowing the hunters to kill the natural destroyers of these insects, — the birds. It seemed to me that education as well as legislation was needed to protect them, and accordingly I planned two Bird Field Days, the first of the kind probably ever held in the country, and their success was due to the splendid co-operation of our State master, State Ornithologist, Audubon Society, our efficient State



Three nesting boxes on one tree, all occupied by birds, on the reservation of the Massachusetts Commission on Fisheries and Game at Martha's Vineyard. (Original photograph.)



A row of nesting boxes on a pasture fence on the farm of William P. Wharton, Groton. (Original photograph.)

grange bird committee, the public press of Massachusetts, and especially the Worcester "Telegram." More than 1,000 people attended the Bird Day at Green Hill Park, Worcester, and about 300 at Pittsfield. The Pittsfield meeting was to have been held at the farm home of John H. Noble, but a rainy day compelled us to have it in the hall. A bird pageant had been prepared by Mrs. Noble, but was omitted on account of the rain. Patrons, no one line of grange work has called more attention to our order than these Bird Days. . . .

With your co-operation we hope to begin a work which will not only attract the birds but will perpetuate the name of the grange, and, best of all, interest the school children in the protection of the birds. At these Bird Days we hope to have children who have done meritorious nature work in the schools put up bird houses in the name of the grange. Patrons, can you not see if this work is started what the result will be in a few years? It will mean not only financial results on the farms and a greater interest in the work of the grange, but more than that. It will arouse a new interest and love for the birds in the children of our State. It would be a rare child that would not be anxious to see the "first bird" that occupied "his" bird house, and if I am any judge of children, I do not believe it would be long after putting up the first bird house before others would appear around the homes of the children, and there would be less killing of the birds. The members of your bird committee have spent a great deal of money from their own pockets to carry on this work for us, and I do not believe after you realize fully the importance of this department of grange work you will continue to ask them to do so longer, and I would suggest that you allow them the sum of $100 to use for this work during the coming year.

I hope the master of every grange in the State will appoint a committee on birds, and at least one meeting during the year to be devoted to this study.

Among other good works the State grange bird committee has issued the following, which has been sent out to all grange lecturers: —

Grange Programs for Bird Nights.

1

1. Decorations.
2. Lists of species seen by bird students during the year, beginning January 1.
3. Papers: —
    The Resident Woodpeckers: Downy and Hairy.
    The Native Sparrows.
    The Robin.
    Our Wealth of Wild Fowl.
    The Relations of Birds and Trees.

4. Discussions: —
    Should Farmers in this Locality keep their Lands posted?
    Should we unite to keep Large Areas posted and to see that Enemies to Bird Life are kept in Check?
5. Readings and Piano Imitations of Bird Notes from Matthews' "Field Book of Wild Birds and Their Music."
6. Announcement of prizes for: —
    Best List of Species seen during the Year.
    Greatest Number of Bird Houses put up.
    Greatest Number of Occupied Bird Houses.

Grange Melody: The Wild Bird.

2

1. Papers: —
    Bob White.
    The Thrush Family.
    Our Permanent Residents.
2. Stories about Observations on Birds made by Members Personally.
3. Discussions: —
    Which are most Valuable, the Cherries Birds eat or the Trees they save?
    How can Useful Birds be increased?
4. Contests: Identifying Birds by their Pictures.
5. Original Imitations of Bird Notes.

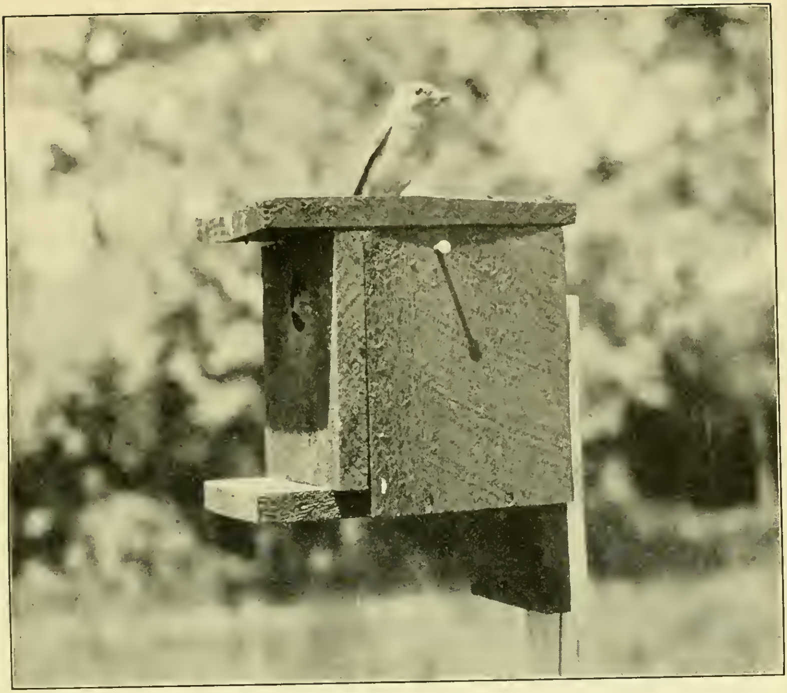
3

1. Papers: —
    The Chipping Sparrow.
    The Swallow Family.
    Our Winter Visitors from the North.
    Economic Value of Birds and Other Values.
2. Stories of Hunting with a Glass or Camera.
3. Discussions: —
    Which constitutes the Greatest Check on Insect Increase, the Work of Birds or the Work of Men?
    Is it Right to wholly exterminate any Bird or Animal, however Useless it may seem to this Generation?
4. Contest: Representations of Birds by Members.

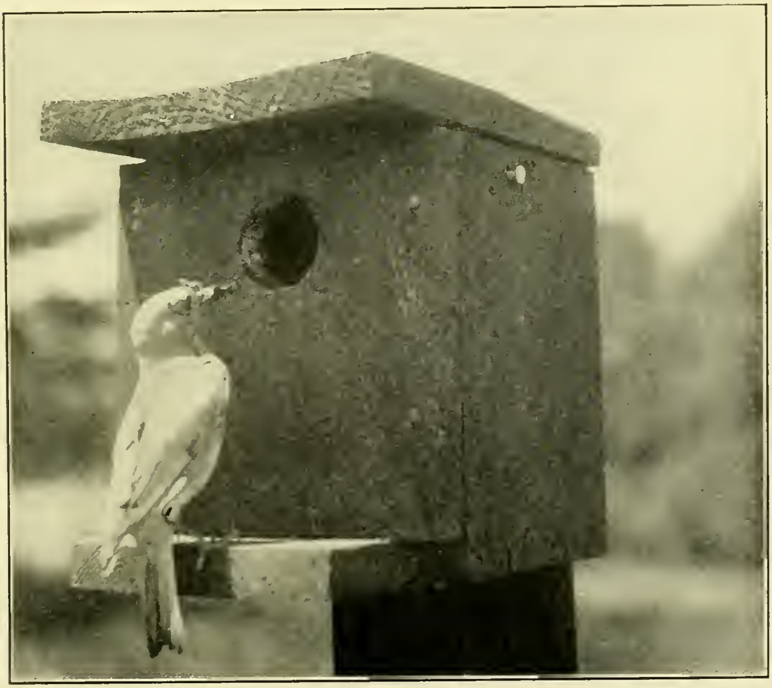
Suggestions.

Where there are not bird students in a grange, it is better to have competent lecturers, and allow questions to be asked at the close of the lecture.

A committee for bird night, or a regular bird committee in a grange is very useful.



Nesting box made by E. C. Ware, Wareham, Massachusetts, with female bluebird bringing caterpillar to her young. (Original photograph.)



Nesting box, with male bluebird bringing insects to his young. (Original photograph.)

Decorations. — Halls are brightened for bird nights with 2-cent Perry pictures. They are best remembered if grouped in families, a study of which may be made from Reed's "Bird Guide." They may be tacked on cloth or paper.

Lists. — All members are encouraged to make yearly lists of all the birds they can identify. Lecturers try to use care lest in rivalry for long lists there is carelessness in identification. Daily lists are even more educational than yearly.

Prizes. — Prizes which have been announced at the beginning of the year or on bird night may be awarded at the grange fair in autumn.

Contests. — 1. The miniature pictures of Reed's, of which there are 80, are far more accurate for identifying than Perry's. These pictures are grouped around the hall with names covered. Members write the names of these, and those who make the best lists receive appropriate prizes, as a book, "Land Birds," a bird box or simply an Audubon leaflet.

2. Each member wears something to represent a bird. This is more certain to succeed if some one person will furnish every member with a paper with the name of some bird "jumbled," namely, the letters misplaced, these to be pinned on the shoulder. Then all go about examining the names, and those who get the best lists have little prizes.

Time of Bird Nights. — A good time for bird nights is in April or May. May is the greatest of all months for song.

The secretary of the bird committee at New Salem will furnish information and correspond with any one interested in birds. The chairman at Princeton is always ready to help in the work.

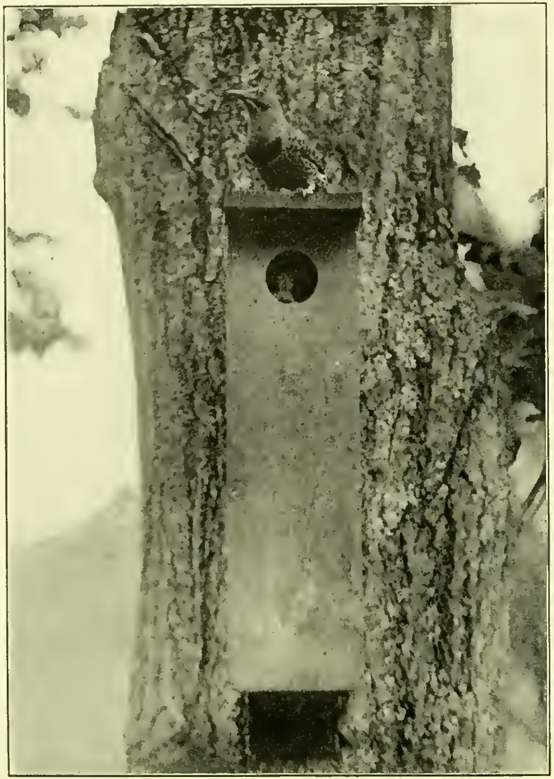
Also, several other circulars with suggestions have been sent by the bird committee to the subordinate granges throughout the State.

Bird Club Exhibits.

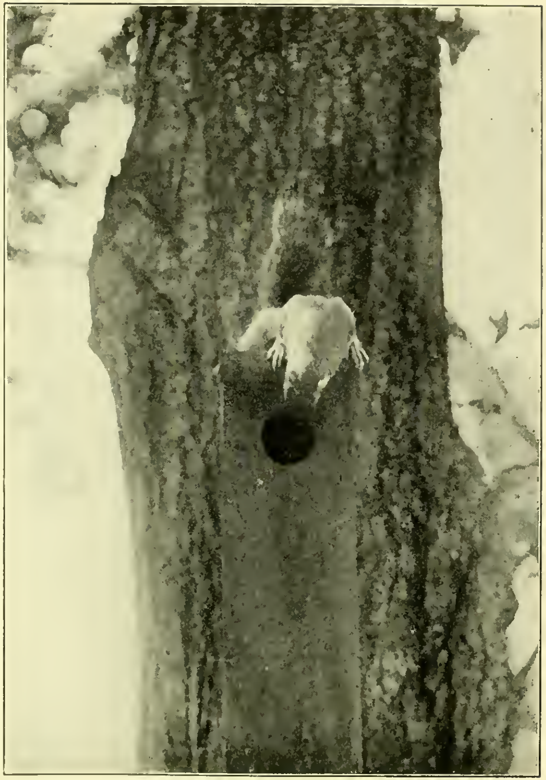
Since the successful work of the Meriden Bird Club at Meriden, New Hampshire, has become widely known through the efforts of the manager, Ernest Harold Baynes, many clubs have been organized for the protection of birds, and Massachusetts has been one of the foremost States in this movement. In 1914 the Brush Hill Bird Club of Milton, Massachusetts, was organized, and under the leadership of its president, Dr. Joel A. Goldthwait, and its energetic general manager, Dr. Harris J. Kennedy, planned a unique exhibit of materials and appliances for attracting and feeding birds. The scope of this exhibition was enlarged to include almost everything relating to bird protection, and the exhibit, which was held in the Milton Public Library, probably was the first public display of the kind ever undertaken in this country. Under the circumstances, it was surprisingly complete. There was a fine show of bird houses, nesting boxes and feeding stations made by various manufacturers and by members of the club. There were bird baths of many kinds and a collection of branches of different species of trees, shrubs and vines bearing fruit attractive to birds, both native and foreign, displayed on a white background. Seeds of many kinds, and dried fruits for bird food, were shown, as well as home-made bird food, the food stick and the birds' Christmas tree. Traps for English sparrows, bird books, bird charts, bird leaflets and pamphlet literature, bird portraits and colored plates, bird drawings and cuts colored by children, bird games, cardboard outlines for making birds, bird laws, posters for protecting birds, — all were shown.

The exhibition is well described and illustrated in the first annual report of the Brush Hill Bird Club, which may be obtained of Dr. Harris Kennedy, Milton, Massachusetts. This report has an appendix containing a list of the birds of Milton by Ralph E. Forbes, and other interesting and useful information.

The exhibit was well attended, aroused much interest, and several requests were made immediately for permission to show it in other towns. These requests could not be granted, as the specimens of wild fruit had dried and faded during the weeks of the exhibition, but a considerable part of the material was sent to Brookline, where the Brookline Bird Club and the Brookline Forestry Department opened a still larger exhibition in the public library of that town. This undertaking also attracted much attention. Later, smaller shows were held in Nahant and Lynn, and at the Children's Museum at Jamaica Pond, Boston. The Brush Hill Bird Club deserves great credit for having inaugurated such an undertaking. The Massachusetts Audubon Society now keeps some of the most stable features of such an exhibition on view permanently in the council chamber of the Museum of the Boston Society of Natural History, corner Berkeley and Boylston streets, Boston.



Male flicker and young at nesting box made by E. C. Ware of Wareham, Massachusetts. (Original photograph.)



Gray squirrel about to enter flicker's nesting box. Squirrels drive birds from nesting boxes. (Original photograph.)

AN EDUCATIONAL NESTING BOX CAMPAIGN.

This report has already referred to the 1,000 nesting boxes which were put up in 1914 by members of the Fish and Game Protective Association, the Commissioners on Fisheries and Game and others, but no mention has been made heretofore of the thousands of bird houses and nesting boxes put up by individuals, — farmers, business men, teachers and pupils in the schools. Many children who have attended my lectures have made and put up nesting boxes. Manual training classes have been making bird houses. The towns of Brookline and Dover, which have bird wardens, have made and put up hundreds. Many of these were furnished by citizens either on their own initiative or under instruction by the bird wardens. Park authorities elsewhere have placed hundreds. Nesting boxes of the von Berlepsch model, imitating the nests of woodpeckers, have been much used in the hope of attracting woodpeckers to nest in them. These have been used to some extent by flickers, but by no other woodpecker in Massachusetts, so far as the returns have come in.[1]

We have found by experience that inexpensive rectangular nesting boxes are more popular with Massachusetts birds. These may be made by any one, or the smaller sizes may be purchased at a low price. The year's experience shows that some birds prefer nesting boxes with an inch or two, or even more, of ground cork, or coarse sawdust and dry earth, in the bottom of the box when it is set in place.

Also, it has been proved that the old idea of erecting a few nesting boxes here and there is not nearly as successful as to set up a large number in a limited space.

The town of Brookline placed about 100 boxes on trees scattered over the town. In one of these a pair of flickers nested. Squirrels and English sparrows occupied nearly all the others, evidently driving out other birds. Blue birds, tree swallows and wrens cannot long defend themselves against these enemies. The flicker, being larger and stronger, may be able to do so occasionally.

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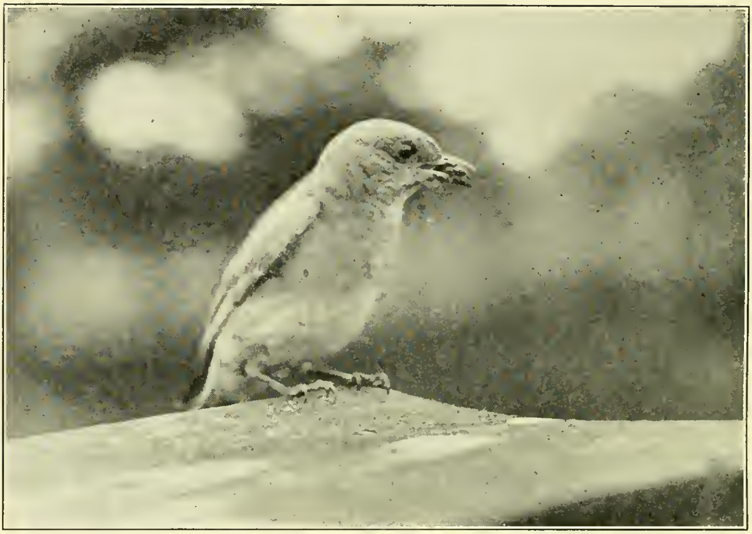
[1] It is said that Henry Ford of Detroit, and Ernest Harold Baynes of Meriden, New Hampshire, have succeeded in getting the downy woodpecker to nest in these boxes.

Frank J. Dutcher, park commissioner of Hopedale, reports that the park department, having a large tract under its care, much of which was wooded, put up in trees a goodly number of nesting boxes of the von Berlepsch style, and that hardly one was occupied by birds, but nearly all were taken by red, gray and flying squirrels. In many other such cases the result has been the same. In such a case the increase of squirrels securely established in the boxes might do much to reduce the number of small birds, as individual squirrels of most species destroy the eggs and young and even kill adult birds when they can catch them.

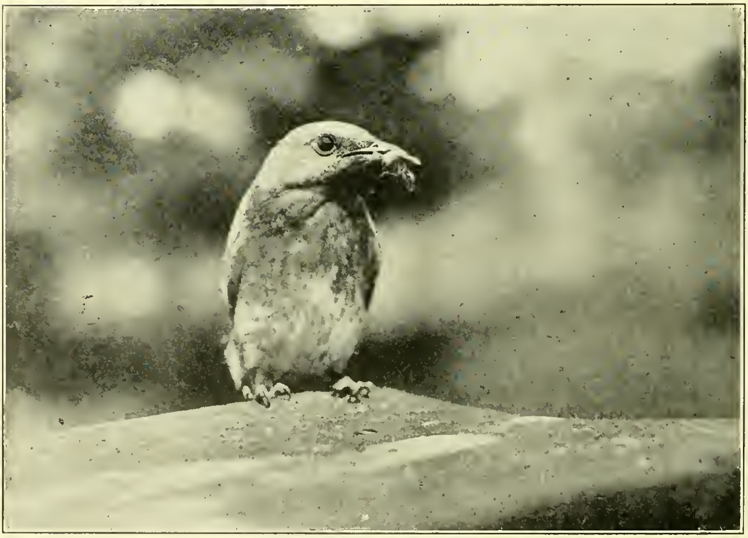
Nesting boxes should be put up by some one with experience in such matters, if possible. They should be placed on isolated shade or fruit trees that can be banded with a wide strip of zinc placed at least four feet from the ground to prevent cats, rats, mice and squirrels from climbing them, or put up on short poles fastened on fences in open fields or projecting above the tops of fruit trees. Nesting boxes on poles in the open are not so attractive to predatory animals as are those on the tree trunks. As a matter of esthetics the nests may be protected by growing thorny vines around the poles.

Before the middle of May, about 75 inexpensive nesting boxes were placed on and near my own farm. This was rather late in the season. Nevertheless, many were occupied by birds. Those placed in trees, in the woods, or near the edge of the woods were not taken by birds, except one which was occupied by a family of flickers. I caught a gray squirrel going into this box when the young were nearly grown. My camera was ready, and the bang of the focal plane shutter served the desirable double purpose of securing his photograph in the act and frightening him away.

No nesting box put on a building was occupied by birds, possibly because squirrels were common in the woods near by and frequently ran over the buildings. Many of the boxes on poles were taken by birds; also three boxes situated on trees in the open. These trees, with one exception, had been well trimmed so that their trunks resembled poles. William P. Wharton of Groton had a similar experience. He had a number of nesting boxes of various patterns in trees a few of which were occupied,



Female bluebird with weevil. (Original photograph.)



Male bluebird with grasshopper. (Original photograph.)

and a large number set on short poles fastened to the fence posts in field and pasture, more than 30 per cent of which were occupied by nesting birds the first year. There are three ways of dealing with the English sparrows: (1) trap, shoot or poison them all; (2) take all their eggs, this will discourage them; (3) put up a quantity of nesting boxes so that when the sparrows have taken all they want there will be enough left for the native birds.

Winthrop Packard, secretary of the Massachusetts Audubon Society, is quite sure that the solution of the sparrow problem lies in the third plan. He set up 20 bluebird boxes on rather less than three-fourths of an acre, and the sparrows were so occupied in choosing from such a plethora that they let the native birds alone. This resulted in the settlement of three times the usual number of swallows and bluebirds, while the sparrows did not increase materially. What will happen next year remains to be seen. I shall try out this plan and report results in the years to come.

Every inexperienced person who attempts to put up nesting boxes should have printed directions advising him about practical details of construction and placing. Many nesting boxes have been placed wrong side up, or in such situations that birds never take them. I shall prepare a circular on this subject soon, and hope that it will be ready for distribution before this report reaches the public. In the meantime, those who intend to put up nesting boxes should have them ready to place in March.

A few might be put up in the fall for the returning migrants to rest in as they pass on, and for birds to use in winter. The rest should be erected in March and April.

Nothing increases the number of birds more readily than secure nesting places. The State government could well afford a few thousand dollars to be expended for placing nesting boxes along roads and railroads, on telephone or telegraph poles.

Birds and Insects.

It was my intention to take time during the summer of 1914 to watch insect invasions and determine as far as possible the effect produced on them by birds, but office work and the demands for my services in many capacities were so great that engagements necessarily were made which interfered sadly with my laudable intentions.

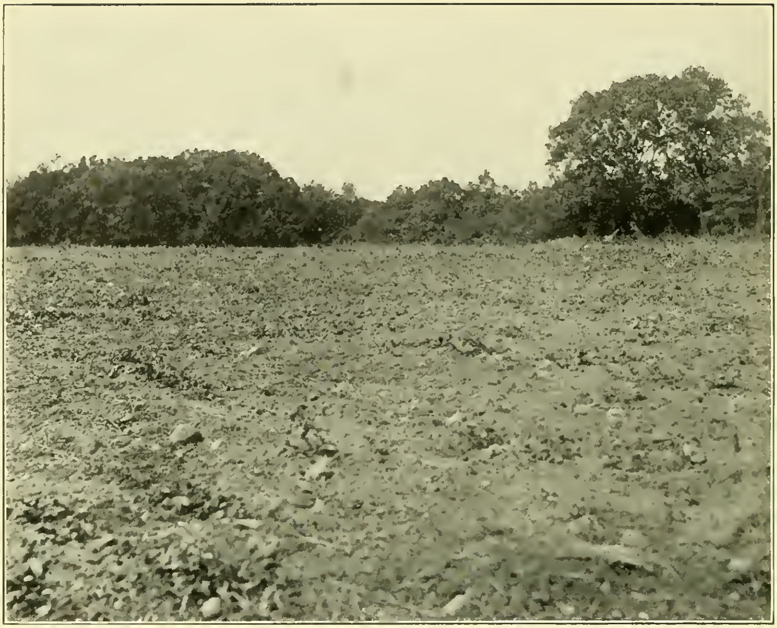
In June, on the estate of William P. Wharton and on my own farm, tree swallows, bluebirds and flickers were watched while feeding their young, and photographed in the act with insects in their bills. The flicker apparently feeds always by regurgitation, carrying the food in her throat or gullet, and in no case could any of it be seen in any photograph taken. Swallows seem to carry food to their young mainly in their mouths, and although some portions of the insects projected from the bill, and we succeeded in getting the camera within three feet of the bird with little difficulty, it is impossible to recognize the insects carried in any case. With the bluebirds, however, there was little trouble, as they carried the insects in their bills and held them up apparently for inspection. It was plain that they were feeding their young on insects from the field, garden, orchard, shade trees and the near-by cranberry bog. Caterpillars, including cutworms and army worms, were brought very often, moths occasionally, many grasshoppers, and weevils or curculios were noted. The accompanying plates show how the food was carried.

Birds and the Army Worm.

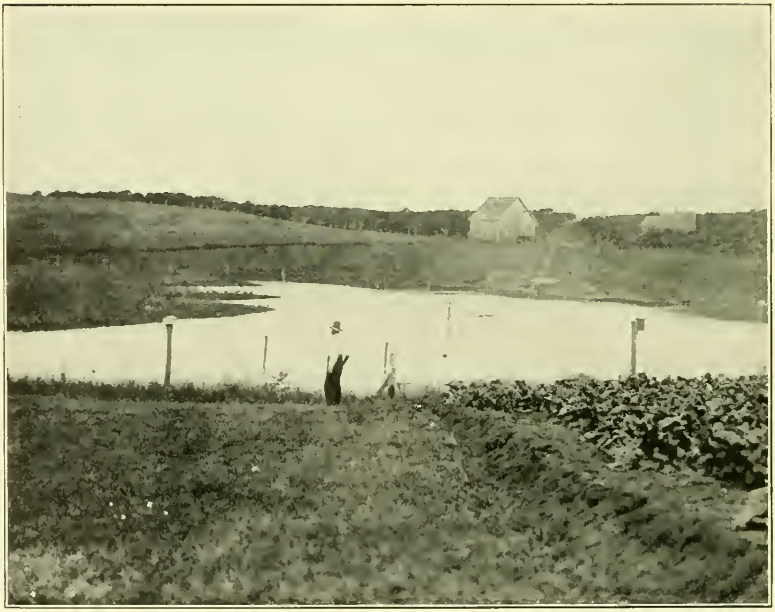
When the army worm outbreak, which extended widely over the eastern States, was first reported it was impossible for me to take the field on account of previous engagements. Reports came in of the destruction of birds by the use of poisoned bran freely recommended by entomologists, but by the time I got into the field the season was nearly over, and it was too late to study the effect of the bran on birds; nevertheless, there were still many army worms and many birds feeding upon them.

On July 31, 1914, I went with Wilfrid Wheeler, secretary of the State Board of Agriculture, to see some outbreaks of the army worm in Plymouth County.

On August 4 I took the first train for Oak Bluffs in company with Walt McMahon. We found evidence of the army worm in the brown turf all about the island near Oak Bluffs, and at



Result of army worm raid on a cornfield in Martha's Vineyard, where no attempt had been made to increase bird life. The corn has been destroyed to the ground. (Original photograph.)



Part of the State reservation on Martha's Vineyard, where heath hens and other birds are protected. The nesting boxes on all the posts on the pond are occupied by birds. The crops were not seriously injured. (Original photograph.)

Vineyard Haven to which we proceeded from Oak Bluffs. There we obtained a team and drove to Professor Shaler's old farm, Seven Gates, North Tisbury. The army worms which had been very prevalent were not nearly as numerous as they had been, and the season appeared to be about over; but at Seven Gates Farm we had a chance to see how destructive this insect can be. Here fields of corn were eaten to the ground. Trenches had been used to protect the corn fields, and had helped some. Nearly all the turf appeared dead and brown. A great deal of poisoned bran evidently had been used in the trenches, as we saw remains of it and many dead worms. The worms were said to be over a foot deep in some of the ditches, but these had been plowed under and we did not see them. We took photographs of the corn fields. We saw very few birds, the inference being that the admission of the people on the ground was correct, — that the poisoned bran had poisoned the birds or else they had been poisoned by eating the worms.

It was reported that on one farm turkeys had been poisoned. Some birds had been picked up dead, and a farmer said that there was no doubt that the birds had been poisoned, but that they could not think of birds while trying to save their crops.

We went to the State game reservation at West Tisbury. At this place the army worms appeared to be nearly as numerous as at the others, but no poison had been used because of the danger of poisoning the heath hens and other birds. Ditching alone had been tried, and the results were much better than at Seven Gates. The corn had been injured very little. The grass had been badly eaten in some of the fields, but apparently no serious harm had been done anywhere. Birds were noticed everywhere. The borders of the fields and bushes were more or less whitened with their excrement, which showed they had been living on insects. Many species apparently were feeding on the army worms. The heath hens were seen in the browned fields apparently picking up the insects, and kingbirds were seen to fly and alight on the grass and fly from one place to another also picking them up.

Among the birds seen to feed on the army worms here and at other places were: chipping sparrow, English sparrow, field sparrow, song sparrow, robin, flicker, bluebird, blackbird. We also found the brown thrasher and the towhee apparently feeding on the caterpillars, and people reported the cow birds, cat birds, pheasants, yellow-legs and upland plovers feeding upon them. Robins appear to be among the most effective of all, and the English sparrows were quite numerous in the browned fields, and were seen time after time feeding on the caterpillar.

On my own place at Wareham I have taken much pains to attract the birds this year, and also on the neighboring farms to the east, and have put up altogether more than 75 nesting boxes. Many are occupied by birds, and although we have seen army worms occasionally, neither I nor my neighbors on whose premises nesting boxes have been put up have had any trouble with the army worm during the year. Less than 20 rods to the west of my place some damage has been done to the grass in the meadows, and from there over and through the town of Wareham much grass was eaten and some corn, but the infestation in that part of Plymouth County was not so great as on Marthas Vineyard.

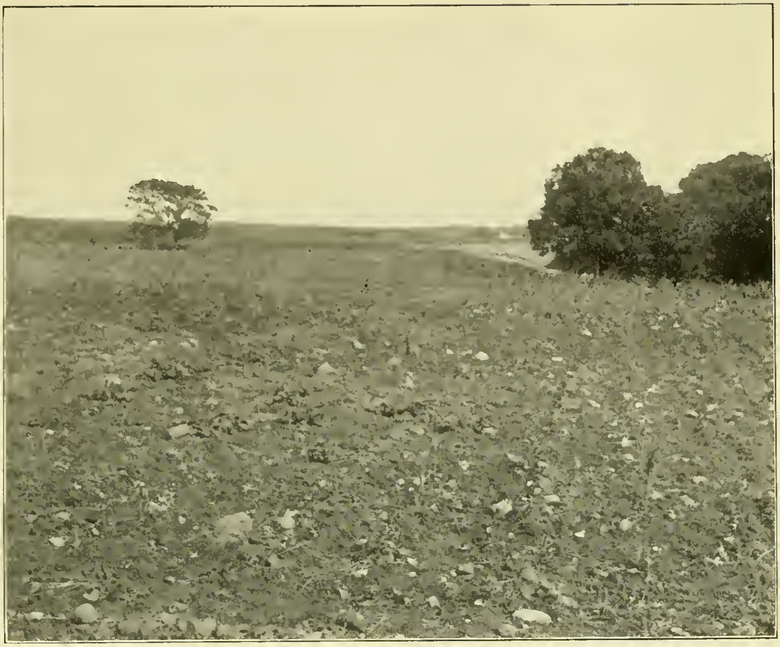
In looking over the infested fields and noting the results, work of the birds was evident. It seems probable that where the worms have not already reached a field they may be kept out of it by careful trenching, and by killing them with kerosene or some other oil as they fall into the pits or the trenches. In many cases this method would have been quite as effective as the poisoned bran.

The following from the "Philadelphia Press" is interesting, although not a new discovery: —

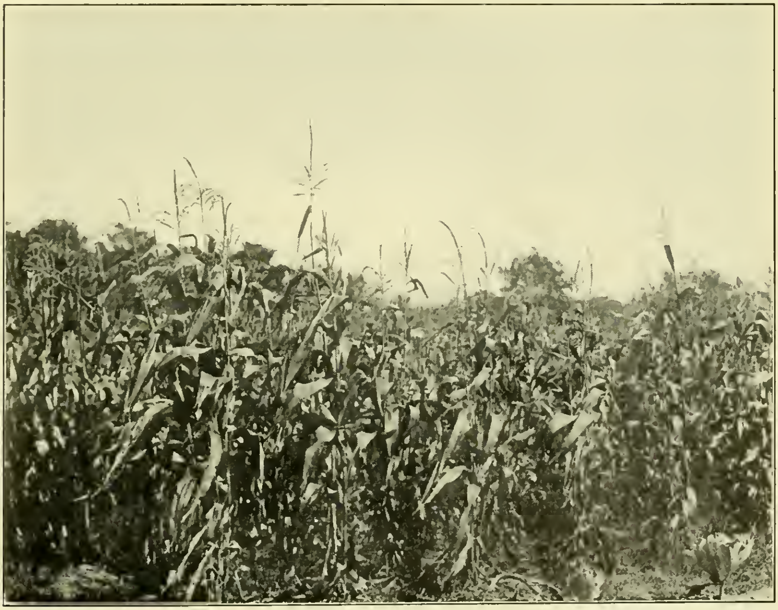
Ducks war on Mosquitoes.

State Health Commissioner Dixon has made a valuable discovery in ascertaining through actual test that ducks eat up mosquito larvæ in water, and do it thoroughly. The many official pamphlets and books that have been published on mosquito extermination since its disease-carrying character has been demonstrated do not as a rule speak of the duck's partiality to a mosquito larvæ diet.

Small fish are given credit for destroying mosquito larvæ, the ever-present minnow in particular. But according to Dr. Dixon's test the duck does much better at that work than the fish. The duck is a wader



Cornfield on Martha's Vineyard where poisoned bran was used, showing ravages of army worm. (Original photograph.)



Cornfield where birds were protected and no poisoned bran was used. (Original photograph.)

as well as swimmer. It searches for food in the shallows and slime of marshes where even the smallest fish is not able to go, yet where mosquito larvæ may abound. It is shallow, quiet water that the mosquito prefers, and if the duck likes the mosquito larva, it is often able to get at it when fish cannot reach it.

On the strength of this testimony from the Pennsylvania commissioner of public health it should be profitable to farmers, and others who may own wet, marshy grounds, to raise ducks and let them have the run of such grounds. It would be cheaper than draining and better than oiling, and would improve the comfort and health of the neighborhood, besides in most cases returning probably an incidental profit on the ducks.

It is a well-known fact that wild ducks, particularly the young, and many species of shore birds feed freely on the larvæ of mosquitoes. We have been killing off these birds at a rapid rate, and at the same time, as in New Jersey, spending large sums to destroy the mosquitoes. Dr. Gaumer tells us that after the destruction of the herons, egrets and other littoral birds on the coast of Mexico, disease increased among the inhabitants of that low-lying swampy region.

We have no exact information as to the cause of this increased sickness and mortality, but we know that the mosquitoes of those regions carry malarial fevers and yellow fever to the human subject. We know also that wild ducks and shore birds eat vast quantities of mosquito larvæ; that herons and wild ducks eat crayfish which destroy the spawn of minnows and other small fish which feed on mosquito larvæ. Knowing so much, we may surmise that there is much more unknown, but it is not difficult to account for the increased sickness on those coasts.

A Martin Catastrophe.

Ever since the long, cold, stormy period of June, 1903, which killed off most of the purple martins in Massachusetts, the species has been rare or absent in the breeding season throughout the greater part of the State. Their numbers had been increasing slowly, however, in Hampden, Worcester, Middlesex, Essex, Norfolk and Plymouth counties, and in the spring of 1914 they appeared in several new localities.

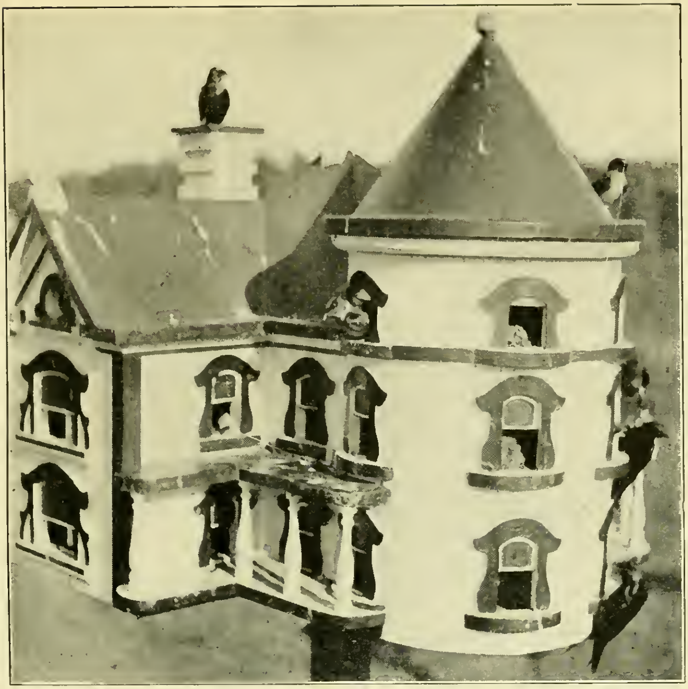
It seemed probable then that by putting up martin houses it might be possible in a few years to re-establish the birds in something like their former numbers, but again disaster has overtaken them. Many martins came in 1914 to Concord, Massachusetts, the scene of Edward L. Parker's successful attempt to establish a colony in 1912, recorded in my annual report for 1913. By watching his bird houses closely I became aware of a calamity which probably overtook most of the martin colonies in Massachusetts.

Late in June, 1914, I went to this colony and made an attempt to photograph the birds in such a way as to show the character of their food. Photographing was attempted by putting up two ladders lashed together, and raising a camera on the upper round of the ladder. During the first day, however, the birds did not come near the camera until late afternoon.

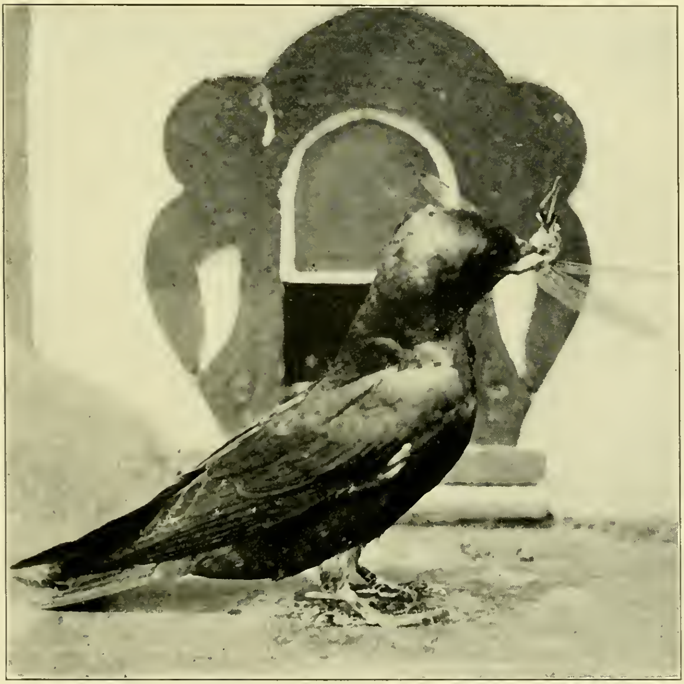
On June 30 the martins, having become accustomed to the camera, brought numerous insects, coming every few seconds with food for the young. There were between 30 and 40 birds in the colony. It was a wonderful sight to see at least 30 birds constantly coming and going, — sailing up to their nests with insects packed in their bills and mouths. Most of them came to the house under observation. Two or three pairs were nesting in another house. Among the insects recognized were the cabbage butterfly, an Argynnis butterfly (frittilary) and many insects with transparent wings. Cutworm moths were brought and moths of other species which could not be identified.

In order to get the camera closer to the birds and get larger pictures, I moved the ladder within three feet of the house and left a potato hook covered with a cloth to represent the camera. This was lashed to the top of the ladder in the same position that the cloth-covered camera had occupied, and remained there for several days, during which I occasionally came and attempted to photograph the birds, but was unable to accomplish much on account of rainy or cloudy weather.

Finally, on Saturday, July 4, the clouds being light, several pictures were secured at close range, showing the birds with insects in their bills. These insects were mostly dragon flies, as the weather had been very cold and more or less stormy, and the dragon flies, being numb with cold, were easily taken by the



Martin box and some of the occupants on the estate of Edward L. Parker at Concord, Massachusetts. (Original photograph.)



Martin about to enter nest with dragon fly. (Original photograph.)

birds. Cold and stormy weather continued until July 9, when I made another attempt to photograph the birds, and found that all the young birds in both houses were dead, and only a few of the old birds remained. Possibly this weather killed most of the adult birds, as few of them have been seen since. Arthur W. Brockway of Connecticut reports a similar experience.

I advised Mr. Parker's man to clean out the house and see how many dead it contained. Mr. Parker wrote me on the 12th that the man had done so, and reported all the young birds dead. There were four or five well-feathered young dead in each nest and one adult bird. The young were well grown and feathered, but he did not count the full number. At least four of the adults were still alive. These began carrying in nesting material after the nests and dead young had been removed, but as the weather continued cold and stormy they did not attempt to rear another brood. The number of martins increased, however, to 12, all of which disappeared in August, probably on the way to the south.

In looking over some swallows' nests to learn if they had been seriously affected by the stormy weather which killed the martins, I found only five dead young, and inquiries of others seem to prove that swallows suffered no serious diminution.

The destruction of the martins, which always suffer most during such storms, may be attributed to their inability to withstand cold or to find insects otherwise than on the wing, for cold storms clear the air of all flying insects. Probably the June and July storms of 1914 were not severe enough to more than decimate the martin colonies, and probably they have left a nucleus for continuing the species.

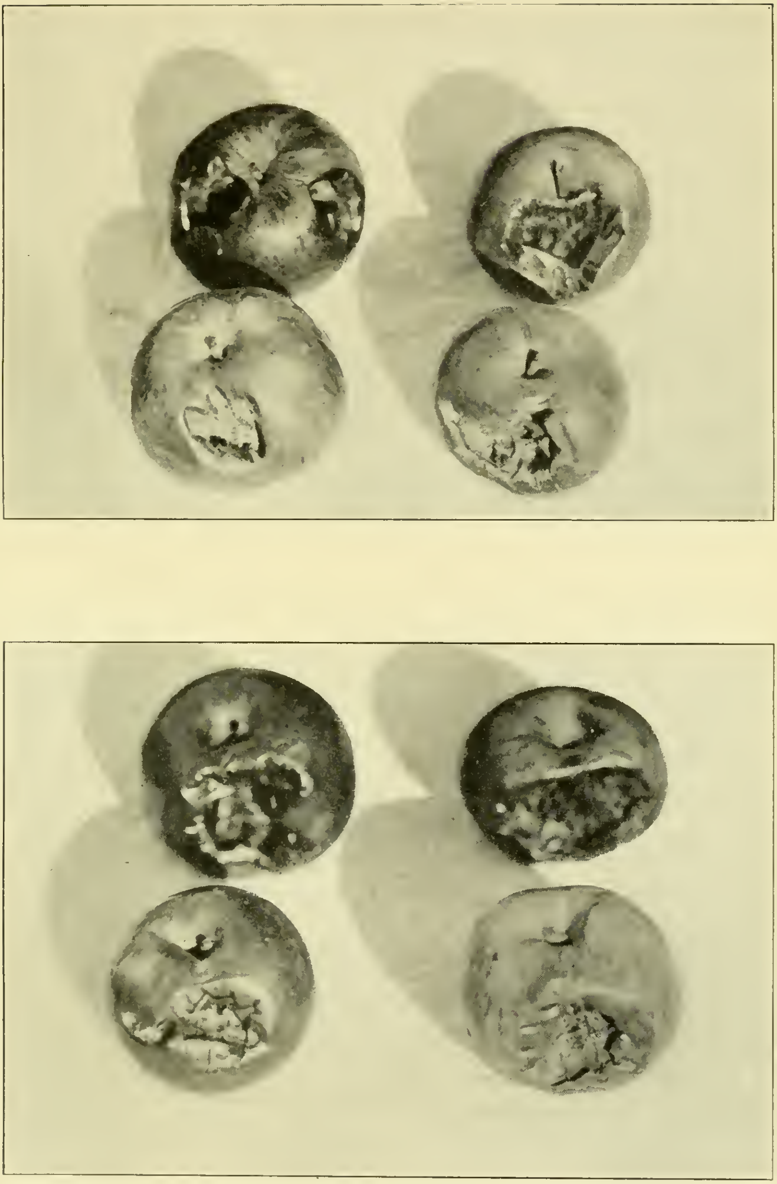
The Starling.

The Old World Starling (*Sturnus vulgaris*) is now quite generally distributed over the three southern New England States, and has been reported from every State in New England. Although it is not yet more than locally common in Massachusetts, it has already begun to show fruit-eating propensities as it did when introduced into New Zealand. In September, 1914, on the farm of William P. Wharton in Groton, I saw apples that apparently had been pecked and ruined by starlings which had summered in the vicinity. Later complaints of similar injury were received from Billerica. Walt McMahon gathered there on the farm of E. F. Dickinson a number of apples which had been pecked by starlings, some of which were photographed for the accompanying plate. It will be seen that the birds take only a little from the ripest part of each fruit. They also attack pears in the same way and eat cherries bodily. When they come in large flocks they strip a cherry tree in a very short time, and they quickly destroy the grape crop. New York, Connecticut, Rhode Island and Vermont have already removed protection from the starling. Massachusetts probably will follow.

The successful introduction of the starling in this country, which is responsible for its establishment here, occurred in New York in 1890. There were several earlier importations of the species which apparently were unsuccessful. John Coulson writes me that four starlings were caught from a small flock on the estate of Stephen Salisbury at Worcester, Massachusetts, on Wednesday, November 8, 1876, between 11 and 12 o'clock noon, and were kept in a room in his house until Saturday the 11th, when some one carelessly let them out. Mr. Coulson, a native of England, knew the bird well, and there seems to be no doubt about the identification.

Good Results of the Protection of Wild Fowl.

Laws for the protection of wild ducks and geese passed in New England in recent years have shown almost immediate results. The protection of these birds all the year, except during the autumn months, thus securing them in a large measure from molestation during the severe weather of winter, and the breeding season in the spring and summer, has resulted (1) in many birds staying here during the winter; (2) an increased number remaining here to breed; (3) a larger number returning in the autumn. I predicted before these laws were enacted that such would be the result. Now the Federal law for the protection of migratory birds has extended protection to these birds over the entire country, and in so far as it has been observed it has had a similar effect. If this law is sustained by the Supreme Court



Apples ruined by the introduced starling (*Sturnus vulgaris*). (Original photograph from Billerica, Massachusetts.)

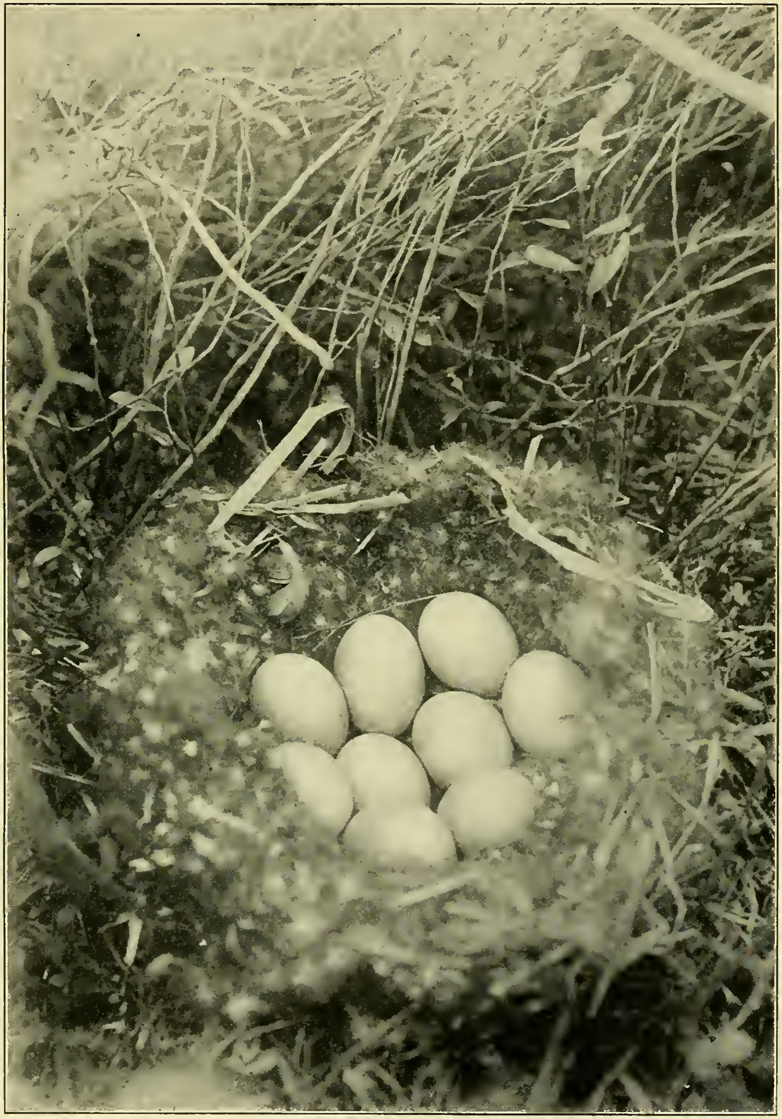
of the United States, if Congress can be prevailed upon to appropriate money enough to enforce it, and if a treaty with Great Britain can be made extending similar provisions throughout Canada, there need be no anxiety felt for the future of American wild fowl. Even then, however, we cannot expect a very great and permanent increase of these birds. There are millions of gunners in the United States and Canada. Many lowlands, swamps and marshes in which these birds now breed will be drained sooner or later and used for agricultural purposes, and eventually artificial propagation will probably have to be resorted to to maintain the stock. In a recent bulletin of the American Game Protective Association (Vol. 2, No. 6, October 15, 1914), Delmar C. Speenburgh, a Federal inspector under the new law, says that it has produced results already far superior to any other protective legislation, especially in regard to the increased number of breeding ducks in the States within his jurisdiction. He asserts that Chief Protector Stratton of the Fish and Game Commission of New Jersey has received reports from all sections of the State that black ducks had nested and were quite numerous in the marshes. Mr. Speenburgh traveled along the coast from Barnegat to Cape May, stopping at the bays and marshes and talking with gunners and sportsmen. He found many ducks there, and in talking with many who had opposed the law he found that they were compelled to admit that the elimination of spring shooting was best, as it had shown them that the ducks, if unmolested, would remain to breed. The most encouraging report comes from southern New Jersey, where it is estimated that from 75,000 to 100,000 wood ducks have been bred and raised this year. Only a few years ago the beautiful wood duck was in imminent danger of extinction. Mr. Speenburgh saw at least 50 wood ducks on one mill pond, also a flock of black ducks. In other localities he saw large flocks of black ducks that had been reared on these breeding grounds.

Teal have been breeding he says in some numbers, and some mallards were seen early in the fall, which he believes bred there. Comments of the press of Minnesota, Michigan, New York and Maine are given in the bulletin, all of which assert that the birds are increasing, in some cases large flocks of wild fowl appearing where until recently there were none; and some aver that there have been more ducks and geese this year than at any time within the recollection of the observers.

Such an increase had already begun in Massachusetts under State law before the Federal law was passed. I have received a number of reports of the breeding of mallards, — something unheard of until within the past few years. The red-breasted merganser or sheldrake, a few pairs of which are said to have bred in the State in recent years, are now summering in larger numbers. There is one report of the breeding of the hooded merganser within the State. A pair summered here, and young birds were seen, but hooded mergansers appear now in the fall in small numbers where they have not been noted for many years. The breeding of black ducks and wood ducks is now so common and widespread that it creates little comment, and now and then a Canada goose or two are seen in the late spring or summer, and a family or small flock now and then appears early in September. No details regarding the whereabouts of any of these birds is given in this report, as experience has shown that the surest way to lead to the destruction of a rare bird is to advertise its locality. Following is a list of species which have summered within the State in recent years, and most if not all of them have bred here: —

Mergus Americanus, ...	Merganser or sheldrake.
Mergus serrator, ...	Red-breasted merganser.
Lophodytes cucullatus, ...	Hooded merganser.
Anas platrynchos, ...	Mallard.
Anas Rubripes, ...	Black duck.
Aix Sponsa, ...	Wood duck.
Branta Canadensis, ...	Canada goose.

In the cases of the mallard and the Canada goose, however, some of the birds remaining with us may have been individuals that escaped from captivity, as considerable numbers of both species are kept as breeding birds or decoys. In some of the other cases one bird of a pair may have been crippled and unable to fly. Such birds sometimes secure mates and nest wherever they happen to be. Probably any of the wild fowl that can endure the summer in this latitude might be induced to nest



Nest and eggs of Massachusetts black duck. (Photograph by I. Chester Horton.)

here. In a conversation with Lord William Percy, the ornithologist of Alnwick Castle, Northumberland, England, he told me that on at least one estate in England it is the custom to trap wild fowl shortly before the nesting season opens, and to clip one wing of each bird, cutting off the feathers very close to the wing. These birds, being clipped and penned, can be later caught again, and the stumps of the quills pulled out. Under these circumstances, it takes twenty-one days to reproduce the feathers. The object of this clipping is to induce the birds to stay and nest. By the time their quills are grown out and they are able to fly, the season has become so advanced that they are ready to nest, and usually will nest in the locality in which they find themselves. Young birds raised in a locality, of course, will come back and breed there again, and in this way a breeding stock of wild birds is established.

No doubt the same plan might succeed in this country. A few years ago, the spring in the west being late and cold, many wild fowl remained to breed in Texas.

Lord Percy makes a special study of wild fowl. He came to this country mainly to study the Eider ducks, particularly the Spectacled Eider (*Arctonetta fischeri*) now believed to be nearly extinct. He passed a part of the summer of 1914 in Alaska and northern Siberia, where the few remaining individuals of that species now exist, but went home to join his regiment after the outbreak of the European war.

Wild Fowl starving in Winter.

In February, 1914, severe cold weather froze over the flats along the coast of southern New England, depriving many wild fowl of their food. There is reason to believe that some birds perished of starvation and cold. There were great flocks of black ducks and golden-eyes in Boston Harbor. The authorities at Thompson's Island fed the black ducks with grain, and as all shooting is illegal within the limits of Boston, the birds were well protected and apparently none died from cold and starvation. Much suffering was reported, however, among wild fowl in southeastern Massachusetts, and the deputies of the Massachusetts Commission on Fisheries and Game were instructed to feed wild ducks with grain. Wilbur Smith, Fairfield County game warden at South Norwalk, Connecticut, wrote me that "a good many" ducks died along the Connecticut shore. It was his opinion that not less than 200 ducks died in one locality in his territory. It is interesting to note that even the scaup or broadbill ducks, which are divers and can obtain food in fairly deep water, were starved. Mr. Smith speaks of picking up three from the ice at one time, and seeing six lying on the ice not more than twenty feet away, while scattered over the river and on the "Island" were crows which "under the glass could be seen eating dead ducks." Fortunately a thaw came just in time to save many water fowl from actual starvation.

Birds in the City.

Everybody goes to the country to see birds. Few people realize how many birds visit open spaces in the city during migrations. These open, flowering, tree-studded, grassy spaces amid the wilderness of brick blocks and city streets attract the weary migrants. Perhaps the night glare of the city confuses them in their nocturnal flight, and brings them down to seek the rest and food to be found in the parks. Many a strange visitor may be found there in the early morning. Bradford Torrey relates that a friend applied to a distinguished ornithologist for his advice regarding a locality to find certain rare warblers, and was told to go to Central Park, New York. The diversity of vegetation in the parks provides food suitable for many species. A few still live and breed in city parks. Dr. and Mrs. E. W. Vietor have been kind enough to send me an excellent monthly record of the birds seen by them in Prospect Park, Brooklyn, New York, in 1914. The list contains the number of species and individuals noted on each day that the park was visited. These visits were made from seven to thirteen days in each month. In May, 85 species were seen, and the greatest number of individual birds seen in one day was 393. English sparrows were not counted.

The smallest numbers of species (14) were seen in both January and February, and the smallest number of individuals seen was 21, on February 4. Probably it would be difficult to find in

Boston parks such a number of birds as these reports show. The numbers are increased by starlings, which are found in Prospect Park practically all the year. With this exception, however, an observer in Boston might secure nearly as large a list as that of the Vietors' in Brooklyn.

Horace W. Wright, in his "Birds of the Boston Public Garden," published in 1909, gives a list of 116 native species, 2 introduced and 2 foreign species. Since this list was published, many besides myself have seen there another native species, — the hooded warbler. Dr. and Mrs. Vietor have recorded 162 species for Prospect Park.

Respectfully submitted,

EDWARD HOWE FORBUSH,
State Ornithologist.

FIFTH ANNUAL REPORT

OF THE

STATE INSPECTOR OF APIARIES.

Presented to the Board and Accepted,
January 13, 1915.

FIFTH ANNUAL REPORT OF THE STATE INSPECTOR OF APIARIES.

To the Honorable State Board of Agriculture.

There is a considerable degree of satisfaction in presenting the fifth annual report of the State Inspector of Apiaries for the fiscal year ending November, 1914. Satisfaction has been expressed not only among beekeepers but among the deputy inspectors, who have worked faithfully and earnestly, as follows: John Shaughnessy of Stockbridge, who has previously served as an inspector; O. F. Fuller of Blackstone, who was appointed on June 23, 1914; and Edwards Thorne of Westborough, who was appointed on July 24, 1914. The writer acknowledges his appreciation of their services and congratulates them upon their success. Success, too, could not have been expected in some instances even by the most optimistic. Particular evidence of the possibilities in disease suppression will be shown below in the discussion of the results in Berkshire County, for instance, where disease was formerly exceedingly prevalent. Your inspector, therefore, is under the impression that with adequate facilities and further persistence, Massachusetts may be relatively rid of infection, perhaps freer of bee diseases than any other State in the Union. This is a sweeping statement, but the success of the past year leads me to hope for a relatively disease-free State. It is necessary that funds be provided so that the entire State may be supervised; at present the size of the appropriation limits efforts to certain districts, which, as the writer has previously explained, are selected according to the prevalence of disease in them.

A notable illustration of the need of additional assistance has come to light during the past season in southeastern Massachusetts, where heretofore the disease situation had not been considered serious. An inspector there discovered by a careful apiary-to-apiary inspection that disease is rooted more seriously in this locality than had been supposed. Furthermore, he brought to light the fact that the section in question is as well adapted for beekeeping as any other part of the State, and found honey crops which rival those of the most prosperous apicultural territory in the eastern United States. Not only is a large number of bees kept there and large quantities of honey produced, but its quality is high. Notwithstanding poor management in some cases, it has been found that particularly fine crops have been obtained. The superb comb of white clover honey in the illustration was from this locality. This part of the State, therefore, is especially encouraging, but the first thing to do is to rid it of disease. The writer feels certain from the success in Berkshire County and other quarters of the State that it is possible.

There is another cheerful side to the outcome of inspection thus far. It had been feared that possibly disease had so reduced the number of colonies in some localities, or had so discouraged beekeeping, that it might not be taken up again. Figures are now at hand, however, which prove the contrary, and in localities where disease has been brought under control, beekeeping is regaining its rightful proportions. Furthermore, beekeepers are tending to become more proficient and expert every year. Consequently there has been a healthy growth in the industry. Even more encouraging results may be expected when climatic and seasonal conditions will favor the honey crop, which was not the case during the season of 1914. In most territory east of the Mississippi River, there has been a total failure in honey production this year, as well as for two or three years past. Such conditions cannot prevail indefinitely; beekeepers are hoping for a change in 1915.

Berkshire County is approaching Disease-free Condition.

In 1911, when the first serious effort toward the general control and suppression of infectious bee diseases was made in the westernmost county of Massachusetts, 45 per cent of the apiaries were found diseased. Moreover, one-half, or nearly so (43 per cent), of the colonies in these apiaries were infected with European foul brood. It is generally supposed that this

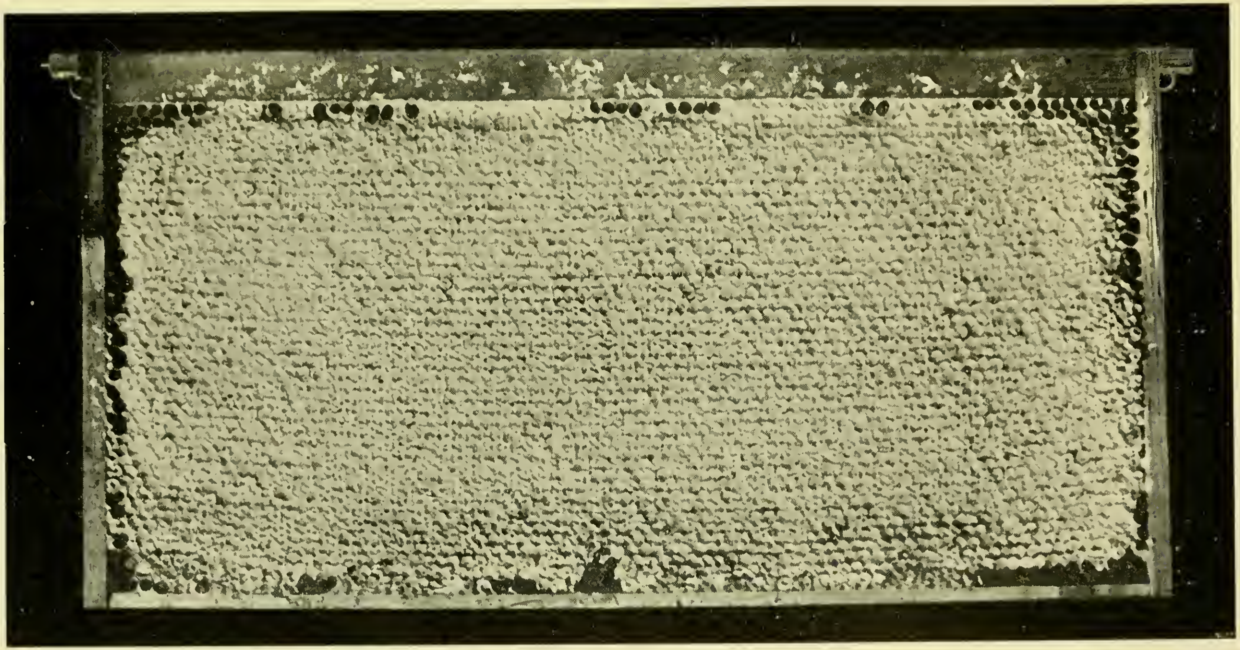


FIG. 1.—This comb is one from a beekeeper's 1914 honey crop in the vicinity of New Bedford, estimated at about a ton. In 1913 one of these colonies produced 225 pounds of extracted honey. [Author's illustration.]

disease spread from New York State soon after it gained a foothold in America. Gradually it worked its way, as investigations have shown, toward the east, and has since been found in practically every quarter of Massachusetts. Its prevalence in Berkshire County, however, has been of considerable duration, and has seriously depleted the apiaries and discouraged the beekeepers. The first efforts at suppression were greeted with enthusiasm by many, yet with a bit of skepticism as to the ultimate results. It was not anticipated that in so short a time as three years there would be a decided and marked reduction in disease, together with an increase in the number of colonies in some apiaries. To be sure, this increase has been small as yet, but this has been in part due to unfavorable climatic conditions for three successive years.

The general results are shown in Table 1, and are most encouraging. It will be wrong to make too sweeping predictions from these results, but they show what can be accomplished in a short time by persistent, conscientious and sometimes radical weeding out of disease. It will be surprising, even to some residents of Berkshire County, to learn that the percentage of infected apiaries has in this short space of time dropped from 45 per cent to 14 per cent, with a corresponding and even more marked drop in the number of infected colonies in these apiaries from 43 per cent to 7 per cent.

TABLE 1. — *The Comparative Status of Apiaries in Berkshire County, Massachusetts, in 1911 and 1914.*

YEAR.	APIARIES.		COLONIES.	
	Visited.	Infected.	Examined.	Infected.[1]
1911, ...	154	70, or 45 per cent.	980	439, or 43 per cent.
1914, ...	179	25, or 14 per cent.	1,028	72, or 7 per cent.

[1] European foul brood only in this county.

This comparative status has a more significant meaning. It shows the results of supervision by an inspector who is an educator and an enthusiast. Encouraged by what we have seen accomplished already in Berkshire County, we may hope for even more marked results in the future. Instead of Berkshire County being one of the worst infected sections of the State, as it was in 1911, it is fast becoming one of the freest from infection. The figures do not mean, however, that supervision may now be discontinued. The beekeepers have learned their lesson to a certain extent, yet they still need assistance and special suggestions. Given a prosperous honey year, beekeepers of this county may look forward to a successful season.

These figures, too, are significant from the standpoint of the rest of the State. What is attained in the western county may be reached elsewhere in the State or in the State as a whole; but to do this additional assistance is imperative. The limited funds and number of inspectors do not permit of a State-wide campaign, which from evidence now at hand is most seriously needed. Furthermore, from the standpoint of beekeepers, it is not only desired but demanded. Unfortunately it has become necessary to limit the response to these demands. This should not be the case, for with the demonstrated success in one locality beekeepers of the rest of the State most certainly are warranted in applying for similar assistance.

The Need for Additional Inspection.

While apiaries in every quarter of Massachusetts have at some time been inspected or their status ascertained, with the present available funds it has not been possible to cover the State completely in any one year on account of limitation of time or number of inspectors. As the writer has explained in previous reports, the policy has been to deal with the worst current infection. Now a territory has been found, as explained below, in which there are large numbers of colonies of bees isolated and hard to reach; a territory covering a large area, and which has a most promising future from the standpoint of honey production, but which is seriously infected with both European foul brood and American foul brood. A beginining toward the control of the disease has been made during the past year. This work has to be done, however, at the expense of work elsewhere in the State, some of which was decidedly needed. It is therefore apparent that in order to meet the situation adequately, and to keep under control localities already supervised, there be additional funds which shall provide for the necessary time and help. The request for funds, while it has been contemplated by the inspector, is emphatically made by the beekeepers, especially those in the territory of this new focus of infection.

This focus of infection is in southeastern Massachusetts, and is much more serious than had been previously supposed. Within the last year it has apparently spread, which would not have been the case had it been possible to know the extent of the infection and to watch and supervise it carefully. Travel is impeded by distance and lack of means of transportation. Consequently considerable time is consumed in making the rounds of these apiaries. But it is now only too evident to you that this is worth while, if it will result in the beekeepers of a locality recognizing their possibilities and then becoming rid of their tremendous handicap of infection. It seems probable that most excellent crops of honey should be available. In fact, the beautiful comb of white clover honey, shown in the illustration, was taken by Inspector Fuller from the vicinity of New Bedford, where infection has been found particularly prevalent. This comb is merely one of many, and represents in one instance a crop of 150 pounds from a single colony.

Realizing the gravity of this situation, Mr. Franklin James of New Bedford (now deceased) had prepared a petition to the Legislature for increased inspection funds, and had intended to present the resolution to the beekeepers' societies for their support. This resolution has been prepared and passed by the Worcester County Beekeepers' Association and appears as follows: —

Whereas, The Worcester County Beekeepers' Association, seeing the need of a larger appropriation for the successful suppression of bee diseases and knowing if these diseases are not subdued or held in check, which we believe cannot be done with our present appropriation, a large financial loss is sure to follow, not only to beekeepers but to fruit and vegetable growers who rely upon the bee for the fertilization of the blossoms, therefore be it

Resolved, That the Worcester County Beekeepers' Association ask that an increase in the appropriation be made by the Legislature during the next season.

J. S. Whittemore,
Secretary, Worcester County Beekeepers' Association.

WINTER LOSS.

For the last three years the percentage of colonies lost during the winter has varied. In the inspector's third annual report, it was mentioned that the winter of 1911–12 was pronounced by all beekeepers as the most disastrous one in a good many years, when approximately 40 per cent of all colonies succumbed. During the winter of 1912–13, the loss was approximately 17 per cent. During the past winter, there was again a heavy loss, although not as severe as previously. Among 1,729 apiaries in which 4,210 colonies were put into winter quarters, but 3,129 survived. This was a loss during last winter of approximately 1,081 colonies, or 25 per cent. These figures only point to the decided need for more careful wintering methods. It is entirely unnecessary that one-fourth of the bees of Massachusetts, for instance, should succumb in the winter. In many instances these losses have been due to negligence, and the writer in his last report predicted that fall conditions, which had caused an unusual consumption of honey and stores, might "result in unsuccessful wintering, or starvation" during the winter. Apparently the prediction was fulfilled to the extent that one-fourth of Massachusetts apiary stock succumbed.

TABLE 2. — *Comparison of Winter Losses.*

YEAR.	NUMBER OF COLONIES.		
	Fall Count.	Winter Loss.	Spring Count.
1911–12,	5,199	2,080, or 40 per cent.[1]	3,119
1912–13,	4,347	753, or 17 per cent.	3,594
1913–14,	4,210[2]	1,081, or 25 per cent.[2]	3,129[2]

[1] In 756 apiaries.

[2] In 729 apiaries.

OTHER DETAILS OF THE SEASON.

The number of 729 apiaries in the above-mentioned winter loss figures does not mean that this number alone were under the supervision of the inspector. A total of 1,641 apiaries had attention. These comprise 4,372 colonies. The following table will show the details and special features of the inspection: —

TABLE 3.— *Inspection Details for 1914.*

	European Foul Brood.	American Foul Brood.	Sacbrood.	Examined.	Quarantined.	Destroyed by Inspector.
Number of apiaries,	174	40	29	-	214	-
Number of colonies,	345	121	-	4,372	-	19

Beekeepers taken from the files or discontinued,	358
New beekeepers,	587
Unhygienic apiaries (not diseased),	122
Number of apiaries quarantined,	214
Number of releases,	189

Inspectors recorded 8 apiaries in which both American and European foul brood were found.

SACBROOD.

The occurrence of sacbrood, formerly called "pickled brood," was approximately no more prevalent than in previous years.

EUROPEAN FOUL BROOD DOMINANT.

As heretofore reported, and unfortunately from the standpoint of control, European foul brood is still dominant. American foul brood is considerably reduced. It was found, however, in eight yards more than in the year previous, but it should be borne in mind that a territory which had not been previously inspected was undertaken, and in this territory American foul brood occurred. Although the prevalence of European foul brood still exceeds that of American foul brood, the number of apiaries in which it was found in 1914 dropped from the preceding year from 214 to 174.

MISCELLANEOUS WORK.

Publications. — During the year there have been three additional papers published in the "Apiary Inspection" series. They are: "Annual Report of the State Inspector of Apiaries for the Year 1913," Bulletin No. 7, by Dr. Burton N. Gates; "Soft Candy for Bees," Bulletin No. 7A (excerpt from Bulletin No. 7), by Dr. Burton N. Gates; "Honey Bees as Pollinizers," Bulletin No. 8, by Mrs. Susan E. Howard.

Meetings. — As in previous years, there have been held about the State various meetings and conventions for the beekeepers. It was not found necessary to hold a special emergency meeting, as was reported for 1913. The inspector has presented papers, lectured or demonstrated at upward of eighteen conventions, not all in Massachusetts, and exclusive of demonstrations at agricultural fairs. A partial list of the beekeepers' conventions attended is as follows: Eastern Massachusetts Society of Beekeepers, February 7; Ohio Beekeepers' Association, Athens, Ohio, February 12, 13; Iowa Beekeepers' Association, Ames, Iowa, November 18; Illinois State Beekeepers' Association, Springfield, Illinois, November 20; Worcester County Beekeepers' Association, Worcester, Massachusetts, December 12; Apiary inspection section of the American Association for the Advancement of Science, Philadelphia, Pennsylvania, December 28.

The writer was also requested to address the New Hampshire Agricultural Society meeting at Concord, New Hampshire, on February 12, in an effort to inform New Hampshire beekeepers of their need for inspection, and outline to them the efforts and results in Massachusetts. At Springfield, Massachusetts, January 15, a two days' convention, with addresses and demonstrations, was held under the auspices of the Massachusetts Fruit Growers' Association. At the National Beekeepers' Association convention, the writer, as president, presided. He was unanimously elected president for a second term.

Under the auspices of the Massachusetts Agricultural College, an equipment, consisting of a large demonstration tent, a screen cloth cage for demonstrating the handling of live bees, together with an equipment of display material, was put up at the Fitchburg, Worcester, Brockton and Ware fairs. This was in the nature of an experiment. It met with decided favor, however, and attracted large crowds, there being hundreds at times watching the demonstrations. Without a detailed account of this project of the Agricultural College, it may be said that the inspection service of the State Board of Agriculture benefited decidedly. This new effort has proven decidedly favorable, and, if additional means for inspection work are provided, it would be possible to incorporate a feature of the inspection work in the fair exhibit. Many visitors inquired concerning bee diseases. Much new information as to the location of wild colonies of bees and suspected cases of disease was gained.

FINANCIAL STATEMENT, NOV. 30, 1914.

Appropriation,		$2,000 00
Services of inspectors,	$1,123 75	
Traveling and necessary expenses,	687 64	
Postage,	8 65	
Printing and office supplies,	85 61	
Stenographic and clerical service,	90 82	
		1,996 47
Balance,		$3 53

Respectfully submitted,

BURTON N. GATES,
State Inspector of Apiaries.

TWENTY-FOURTH ANNUAL REPORT

OF THE

DAIRY BUREAU

OF THE

MASSACHUSETTS BOARD OF AGRICULTURE,

REQUIRED UNDER

CHAPTER 89, SECTION 12, REVISED LAWS.

JANUARY 15, 1915.

DAIRY BUREAU—1914.

CHARLES M. GARDNER, Westfield, *Chairman.*
GEORGE W. TRULL, Tewksbury, P. O. Lowell, R. F. D.
OMER E. BRADWAY, Monson.

Secretary.

WILFRID WHEELER, *Executive Officer and Secretary of the State Board of Agriculture.*

General Agent.

P. M. HARWOOD,

Address, Room 136, State House, Boston.

REPORT OF THE DAIRY BUREAU.

The work of carrying out the provisions of chapter 96 of the Resolves of 1913, relating to encouragement of practical dairying, has been continued by the Bureau during 1914.

The number of entries in the clean milk contest of 1913, open to dairies of five or more cows whose owners were practical farmers superintending their own dairies, was 151. The number of entries in the corresponding class in 1914 was 229, an increase of 78.

The cleanliness of the samples taken in 1914 showed great improvement over those of the year before, thus proving that this feature of the work is meeting with excellent results.

In the clean milk contest, 1914, the State was divided into four districts, namely western, comprising the four western counties; central, Worcester county; northeastern, Middlesex and Essex counties; and southeastern, comprising the remaining counties of the State.

Twenty-five prizes ranging from $6 to $50 each were offered in each district. There was also offered a sweepstakes prize of $100. A prize of $125 was offered to the district making the largest number of entries, and $100 to the district making the best showing of clean milk. All the above prizes were awarded except the sweepstakes prize, where the money offered was equally divided among five contestants tied for the position. In addition to the above, 55 honorable mention certificates were awarded, 30 in the central and 25 in the western district.

Six prizes ranging from $6 to $16 each were offered in each district to persons under eighteen years of age, sons, daughters, protégés or actual employees of owners of farms eligible in this contest. A sweepstakes ribbon was also offered.

Five prizes, ranging from $4 to $12 each, were offered in each district to hired men and women over eighteen years of age doing the milking on the eligible farms. A sweepstakes ribbon was also offered. Most of the junior and hired help prizes were competed for and awarded.

Other prizes were offered as follows: —

In Class 2, a prize of $100 was offered for the best system of dairy-farm accounting for practical farmers, competition open to the world. In this class there were 3 entries. The plans submitted by the contestants, practically taken from books already published, so far nullified the object of the award that upon recommendation of the judge the prize was not awarded.

In Class 3, three prizes, $100, $60 and $40, were offered for the best systems of dairy-farm accounting in actual operation. There were 2 entries in this class, and the second and third prizes were awarded.

In Class 4, a prize of $100 was offered for the best plan of a practical dairy barn. Two plans were submitted, and the prize was equally divided between the two contestants.

In Class 5, three prizes, $100, $60 and $40, were offered for practical dairy barns in actual use. There were 11 entries and the three prizes were awarded. Four honorable mention certificates were also issued.

In Class 6, three prizes, aggregating $450, were offered for the best and most profitable dairy-farm operations. No prize was awarded in this class on account of lack of competition.

The total amount of prizes offered was $4,439; the total amount awarded was $3,735.30. A full account of these contests will be found in "Report on Encouragement of Dairying Contests, 1914," issued by the Bureau.

The police work of the Bureau for 1914 resulted in 129 cases in court and 127 convictions. Nine of these were for violation of the milk laws, 27 for violation of the renovated butter law, and 93 for violation of the oleomargarine laws.

In the educational work, the chairman addressed two and the general agent thirty-one meetings during the year. These lectures explained the food value of milk, the work of the Bureau in conducting the encouragement of practical dairy contest, emphasized the necessity for proper remuneration to the producer for milk and other dairy products, also the superior worth of clean, fresh milk and the importance of its production in Massachusetts.

Leaflets A, B, C and D on milk, by P. M. Harwood, were printed, and many thousand copies were distributed during the year. The Bureau has also published Circular No. 11, "Some Bacteriological Aspects of Clean Milk Inspection," by Charles E. Marshall, Ph.D., and Circular No. 13, "The Clean Milk Contest," by P. M. Harwood.

By appointment of His Excellency Governor Walsh, the general agent spent a portion of the summer in Europe studying dairy conditions. His trip was cut short on account of the European war, nevertheless he obtained much valuable information, which will be of great use to him in the conduct of his official duties.

By invitation, the Bureau co-operated with the Boston Chamber of Commerce in its recent milk hearings in Massachusetts where the chairman of the Bureau presided. The general agent attended the following hearings: Boston and Worcester, Massachusetts; Portsmouth, New Hampshire; Newport, Augusta and Auburn, Maine; and Bellows Falls, Vermont.

The Bureau takes this opportunity to express its appreciation and thanks to Professor J. A. Foord of the Massachusetts Agricultural College, who acted without compensation as judge in Classes 2, 3, 4 and 5 of the encouragement of practical dairy contest, and to Professor Simeon C. Keith of the Massachusetts Institute of Technology, judge in Class 1, both of whom showed excellent judgment in the discharge of their duties. The Bureau also feels under special obligation to Mr. G. L. Berg, milk inspector of Worcester, who did much to make a success of the clean milk exhibit at the Worcester meeting, and to those milk inspectors of the State who co-operated with the Bureau in carrying on the clean milk contest during the year.

THE DAIRY SITUATION.

Much is sometimes made of the fact that there is a decline in the number of dairy cows in Massachusetts. That Massachusetts is no worse off in this respect than some other States, and not so badly off as the States immediately north of us, is overlooked.[1] The elimination of unprofitable dairy cows and the dropping out of unsuccessful dairymen, for whatever cause, as well as the inevitable reduction of the milk supply to such a point as will ultimately bring the price of milk to a profitable figure, are but the natural results of an inadequate price for milk.

The decline in the number of cows is greatest in those localities where milk is shipped by rail to large cities for consumption. It is, therefore, perfectly natural that nearby localities are first to be affected. This decline, however, does not stop but goes on and on no matter how far the area of milk supply is extended, and the near future will, undoubtedly, see further decline, especially in northern New England and even in Canada, until milk producers come to a realizing sense of the great fundamental fact that milk has been too long sold below cost price. Milk production will decrease until the great law of supply and demand does its share of the work in rectifying the situation. The remedy, so far as we are concerned, is the education of the consumer to the food value of milk as compared with other animal foods, together with the education of all to the exact knowledge of the producer's position. Greater economy in milk production must be practiced. Better cows, more scientific feeding and improved business methods are urged of the farmer. Economy in handling, especially in the method of distribution, is urged of the distributor, and a sense of justice and willingness to pay a fair price for milk is urged of the consumer.

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[1] The number of cows assessed in Massachusetts in 1905 was 181,920; in 1914, 147,209, showing a decrease in ten years of 34,711 cows, or 19 per cent.

The number of cows assessed in New Hampshire in 1905 was 113,712; in 1914, 86,438, showing a decrease of 27,274, or 24 per cent.

The number of cows assessed in Maine in 1905 was 165,216; in 1914, 130,661, showing a decrease of 34,555 cows, or 20 per cent.

In Vermont, ten years' figures are not available. Commissioner Brigham writes that the falling off of milch cows and other neat stock, 1913–14, was 10,700 head, or 3 per cent. It will be seen that this is at the rate of 30 per cent. for ten years.

CONDENSED MILK.

Figures furnished by the Boston Chamber of Commerce concerning the amount of condensed milk handled in Boston in 1914 show an increase of 110,718 cases and a decrease of 2,633 barrels over 1913. Full data concerning this report indicate, on the whole, an increase in the consumption of these products. (See table on page 431.)

OLEOMARGARINE.

The number of retail oleomargarine licenses in force in the State in November, 1913, was 884, while in 1914 it was 778, showing a decrease of 106. In Boston, the number of packages reported by the Chamber of Commerce in 1913 was 127,994, while in 1914 it was 99,999, showing a decrease of 27,995. Oleomargarine produced in the United States in 1913 was 145,227,872 pounds, while in 1914 it was 144,021,276 pounds, showing a decrease of 1,206,596 pounds. This decrease in the manufacture of oleomargarine is due in some degree to a falling off of export trade, but probably more to the reduced cost of genuine butter, for which the majority of people have a decided preference. (See tables on pages 428 and 429.)

RENOVATED BUTTER.

In 1913 there were 38,354,762 pounds of renovated butter produced in the United States, while in 1914 there were 32,470,030 pounds, showing a decrease of 5,884,732 pounds in twelve months. The high mark for the production of renovated butter in the United States was in 1907, when 62,965,613 pounds were produced. The gradual falling off in the production of renovated butter, with the exception of one year when there was an increase (1912), shows that these goods are not meeting with the popular favor originally expected by the manufacturers. (See table on page 429.)

BUTTER.

The average wholesale price of butter in the Boston market for 1913, as reported by the Chamber of Commerce, was 31.7 cents, and in 1914, 29.4 cents, showing a decrease of 2.3 cents.

The annual consumption of butter, Boston output, during 1913 was 71,168,283 pounds, and in 1914, 72,922,533 pounds, showing an increase of 1,754,250 pounds. (Details will be found on page 430.)

PERSONNEL OF THE BUREAU.

The personnel of the Bureau is as follows: Charles M. Gardner of Westfield, chairman, George W. Trull of Tewksbury and Omer E. Bradway of Monson. The executive force, agents, analysts, etc., are as follows: executive officer and secretary, Wilfrid Wheeler; general agent, P. M. Harwood; analysts, B. F. Davenport, M.D., Boston, and Gilbert L. Clark, Emerson Laboratory, Springfield; agent, A. W. Lombard; and three others have been temporarily employed.

SUMMARY OF POLICE WORK.

Total number of inspections,	[1] 6,099
Number of inspections where no samples were taken,	4,277
Number of samples of butter, oleomargarine, all purchased,	1,816
Number of samples of milk and cream,	51
Cases entered in court,	129
Addresses by general agent and others,	36

Cases prosecuted during the twelve months ending November 30, 1914, by months and courts, with law violated, and results, are as follows: —

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[1] There were 45 extra samples taken during the year, therefore this number is less than the sum of the next three items.

Court.	Month.	Number.	Law violated.	Convicted.	Discharged.
Concord, Central Middlesex District.	December, .	6	6 renovated butter,	6	–
Fall River, Second Bristol District.	December, .	6	6 oleomargarine, .	6	–
Plymouth, Third Plymouth District.	December, .	6	6 renovated butter,	6	–
Haverhill, Northern Essex District.	January, .	4	2 oleomargarine, 2 renovated butter.	4	–
Westfield, Western Hampden District.	January, .	1	1 milk, . . .	1	–
Abington, Second Plymouth District.	January, .	4	4 oleomargarine, .	4	–
Fall River, Second Bristol District.	February, .	44	44 oleomargarine, .	43	1
New Bedford, Third Bristol District.	March, .	8	8 oleomargarine, .	8	–
East Brookfield, Western Worcester District.	March, .	1	1 milk, . . .	1	–
Taunton, First Bristol District,	March, .	4	4 oleomargarine, .	4	–
Lynn, South Essex District, .	March, .	4	2 renovated butter, 2 oleomargarine.	4	–
Chester, Western Hampden District.	March, .	1	1 milk, . . .	1	–
Natick, ...	March, .	6	4 renovated butter, 2 oleomargarine.	6	–
Boston, Boston Municipal, .	March, .	2	2 oleomargarine, .	2	–
Cambridge, Third Eastern Middlesex District.	March, .	4	4 renovated butter,	4	–
Lawrence Police, . . .	March, .	2	2 renovated butter,	2	–
Lowell Police, ...	March, .	2	2 renovated butter,	2	–
Haverhill, Northern Essex District.	May, . .	10	4 oleomargarine, 5 renovated butter, 1 milk.	10	–
Salem, First Essex District, .	May, . .	1	1 milk, . . .	1	–
Athol, First Northern Worcester District.	May, . .	1	1 milk, . . .	1	–
Southbridge, First Southern Worcester District.	August, .	1	1 milk, . . .	1	–
Springfield Police, . . .	September, .	1	1 milk, . . .	1	–
Northampton, Hampshire District.	November, .	1	1 milk, . . .	1	–
Cambridge, Third Eastern Middlesex District.	November, .	5	5 oleomargarine, .	4	1
Somerville Police, . . .	November, .	4	4 oleomargarine, .	4	–

NOTE. — The Bureau is indebted to the milk inspectors of Massachusetts for assistance which has resulted in court cases.

The charges in the several cases entered in court for the year ending November 30, 1914, have been as follows: —

Furnishing oleomargarine in restaurants, etc., without notice to guests, ...	82
Selling renovated butter in unmarked packages, ...	27
Selling adulterated milk, ...	9
Selling oleomargarine in unmarked[1] packages, ...	8
Selling oleomargarine without sign on vehicle, ...	3
	129

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[1] In these cases oleomargarine was sold when butter was asked for, but the charge was made in this way for convenience.

The following table shows the inspections without samples, and the number of samples taken during the past twelve years: —

YEARS.	Inspections without Samples.	Samples.
1903–13 (inclusive),	56,291	18,127
1914,	4,277	1,867
Total for twelve years,	60,568	19,994
Average,	5,047	1,666

TABLES RELATING TO OLEOMARGARINE.

The number of United States oleomargarine licenses in force in Massachusetts in November, 1913 and 1914, is as follows: —

	1913.	1914.
Wholesale licenses in Boston,	19	21
Wholesale licenses in other cities,	12	19
Totals,	31	40
Retail licenses in Boston,	121	104
Retail licenses in other cities and towns,	763	674
Totals,	884	778

The following figures, taken from the annual report of the United States Commissioner of Internal Revenue for 1914, show the production, withdrawn tax paid, and withdrawn for export of the two classes of oleomargarine, as defined by act of May 9, 1902, covering the period of twelve years, since it went into effect on July 1, 1902: —

Oleomargarine (Pounds).

YEAR.	PRODUCT TAXED AT RATE OF 10 CENTS PER POUND.			PRODUCT TAXED AT RATE OF ¼ CENT PER POUND.		
	Produced.	Withdrawn Tax paid.	Withdrawn for Export.	Produced.	Withdrawn Tax paid.	Withdrawn for Export.
1903, . . .	5,710,407	2,312,493	3,334,969	67,573,689	66,785,796	151,693
1904, . . .	3,785,670	1,297,068	2,504,940	46,413,972	46,397,984	123,425
1905, . . .	5,560,304	3,121,640	2,405,763	46,427,032	46,233,691	137,670
1906, . . .	4,888,986	2,503,095	2,422,320	50,545,914	50,536,466	78,750
1907, . . .	7,758,529	5,009,094	2,695,276	63,608,246	63,303,016	129,350
1908, . . .	7,452,800	4,982,029	2,522,188	74,072,800	73,916,869	109,480
1909, . . .	5,710,301	3,275,968	2,403,742	86,572,514	86,221,310	112,958
1910, . . .	6,176,991	3,416,286	2,767,195	135,685,289	135,159,429	97,575
1911, . . .	5,830,995	2,764,971	3,054,344	115,331,800	115,448,006	91,750
1912, . . .	6,235,639	3,174,331	3,044,122	122,365,414	121,945,038	106,160
1913, . . .	6,520,436	4,090,658	2,417,973	138,707,426	138,242,848	59,686
1914, . . .	6,384,222	3,831,706	2,121,162	137,637,054	137,747,982	22,540
Totals, . .	72,015,280	39,779,339	31,693,994	1,084,941,150	1,081,928,435	1,221,017

RENOVATED BUTTER.

The following figures, from the same source as the preceding table, show the production and withdrawn tax paid of renovated butter, 1902–14: —

Renovated Butter (Pounds).

YEAR.	Production.	Withdrawn Tax paid.
1903, ...	54,658,790	54,223,234
1904, ...	54,171,183	54,204,478
1905, ...	60,029,421	60,171,504
1906, ...	53,549,900	53,361,088
1907, ...	62,965,613	63,078,504
1908, ...	50,479,489	50,411,446
1909, ...	47,345,361	47,402,382
1910, ...	47,433,575	47,378,446
1911, ...	39,292,591	39,352,445
1912, ...	46,387,398	46,413,895
1913, ...	38,354,762	38,285,114
1914, ...	32,470,030	32,513,244
Totals, ...	587,138,113	586,795,780

Butter.

The following table shows the average quotation for the best fresh creamery butter, in a strictly wholesale way, in the Boston market for the last ten years, as compiled by the Boston Chamber of Commerce: —

Month.	1914. Cents.	1913. Cents.	1912. Cents.	1911. Cents.	1910. Cents.	1909. Cents.	1908. Cents.	1907. Cents.	1906. Cents.	1905. Cents.
January,	32.5	33.9	36.9	28.8	33.5	30.9	29.7	30.4	25.2	28.0
February,	28.8	34.9	32.5	26.9	30.5	30.0	32.1	31.7	25.2	31.6
March,	27.7	36.4	32.1	24.2	32.0	29.1	30.2	30.2	25.5	28.0
April,	25.1	34.5	32.7	21.7	31.5	27.9	28.4	32.2	22.2	29.1
May,	25.8	28.7	30.4	22.8	29.0	26 6	24.1	31.4	19.9	23.9
June,	27.5	28.2	27.9	24.2	28.2	26.4	24.5	24.3	20.2	20.7
July,	27.9	27.5	28.1	26.0	28.6	27.2	23.6	25.9	21.0	20.6
August,	30.1	28.2	27.1	27.2	29.6	28.2	24.5	26.0	23.8	21.6
September,	30.9	31.3	29.1	27.7	29.6	31.3	25.3	29.2	25.6	21.2
October,	30.9	31.2	31.0	30.4	29.4	31.7	27.5	29.9	26.9	22.1
November,	32.4	31.9	32.9	32.5	30.2	31.4	29.5	27.1	27.6	23.0
December,	32.7	33.8	34.0	35.0	30.0	32.9	31.0	27.5	30.7	23.9
Averages,	29.4	31.7	31.2	27.3	30.2	29.5	27.5	28.8	24.48	24.47

The Chamber of Commerce figures regarding the butter business in Boston for 1913 and 1914 are as follows: —

	1914. Pounds.	1913. Pounds.
Carried over in storage,	8,874,204	8,340,102
Receipts for January,	3,540,476	2,314,428
February,	2,910,790	2,870,790
March,	4,171,261	3,363,435
April,	4,310,917	4,433,969
May,	7,326,985	8,659,092
June,	13,701,274	12,938,572
July,	12,684,474	12,323,011
August,	7,457,341	8,333,419
September,	5,932,317	6,096,706
October,	4,902,471	4,241,941
November,	3,208,117	2,876,134
December,	2,882,011	3,251,088
Total supply,	81,902,638	80,042,687
Exports for year, deduct,	16,903	200
Net supply,	81,885,735	80,042,487
Storage stock December 26, deduct,	8,963,202	8,874,204
Consumption for year,	72,922,533	71,168,283

RECEIPTS OF CONDENSED MILK.

The Chamber of Commerce figures regarding the receipts of condensed milk at Boston for 1913 and 1914 are as follows: —

	1914. Barrels.	1914. Cases.	1913. Barrels.	1913. Cases.
January,	299	22,030	147	19,621
February,	72	32,198	167	24,862
March,	72	38,638	260	30,670
April,	55	26,362	170	22,193
May,	15	29,889	96	21,946
June,	–	35,766	320	38,300
July,	50	47,102	269	39,502
August,	10	66,127	137	22,902
September,	–	35,749	254	28,693
October,	33	22,071	1,328	25,895
November,	40	34,253	130	17,694
December,	205	42,416	206	29,605
Totals,	815	432,601	3,484	321,883

MILK.

Milk brought into Boston by Different Railroads, Dec. 1, 1913, to Nov. 30, 1914, as reported by the Public Service Commissioners (*Quarts*).

DATE.	Boston & Albany.	Boston & Maine.	New York, New Haven & Hartford.	Total.
1913.				
December,	564,660	6,290,180	1,501,612	8,356,452
1914.				
January,	296,935	6,604,900	1,502,442	8,404,277
February,	288,116	6,043,261	1,475,780	7,807,157
March,	372,194	6,629,606	1,640,016	8,641,816
April,	393,512	6,373,612	1,829,712	8,596,836
May,	395,019	7,091,511	1,896,857	9,383,387
June,	445,397½	7,471,728	1,906,124	9,823,249½
July,	395,257½	7,109,790	1,716,631	9,221,678½
August,	506,954	6,717,219	1,498,746	8,722,919
September,	652,448	6,279,826	1,450,443	8,382,717
October,	306,271	6,349,448	1,539,926	8,195,645
November,	293,700	6,182,944	1,625,447	8,102,091
Totals,	4,910,464	79,144,025	19,583,736	103,638,225

Comparative List of Number of Cows assessed in Massachusetts, May 1, 1906, April 1, 1913, and May 1, 1914.

COUNTIES.	1906.	1913.	1914.	DECREASE.		INCREASE.	
				1906-14.	1913-14.	1906-14.	1913-14.
Barnstable,	2,448	2,251	2,243	205	8	–	–
Berkshire,	17,404	15,317	14,796	2,608	521	–	–
Bristol,	13,702	12,803	13,242	460	–	–	439
Dukes,	656	588	623	33	–	–	35
Essex,	17,131	13,456	13,151	3,980	305	–	–
Franklin,	12,715	10,986	10,165	2,550	821	–	–
Hampden,	12,096	9,486	8,947	3,149	539	–	–
Hampshire,	14,383	11,467	10,977	3,406	490	–	–
Middlesex,	29,508	24,060	24,053	5,455	7	–	–
Nantucket,	378	453	423	–	30	45	–
Norfolk,	11,200	9,766	9,397	1,803	369	–	–
Plymouth,	8,465	7,613	7,475	990	138	–	–
Suffolk,	1,186	1,138	922	264	216	–	–
Worcester,	40,544	31,892	30,795	9,749	1,097	–	–
Totals,	181,816	151,276	147,209	34,652	4,541	45	474

List of Massachusetts Farms making Milk of Superior Quality and Cleanliness and selling their Product higher than the Regular Market Price.

LOCATION, FARM.	Owner and Manager.	Approximate Number of Cows.	Where marketed.
Agawam, Reilly Farm,	J. J. Reilly, owner and manager.	17	Springfield.
Agawam, Colonial Farm,	H. E. Bodurtha, owner and manager.	12	Springfield.
Agawam, Elm Shade Dairy,	S. S. & E. F. Bodurtha, owners and managers.	25	Springfield.
Amherst, H. M. Thompson's farm,	H. M. Thompson, owner and manager.	25	Holyoke.
Amherst, U. G. Groff's farm,	U. G. Groff, owner and manager.	34	Amherst.
Andover, Arden Farm,	Wm. M. Wood, owner; J. M. Putnam, superintendent; Austin C. Huggins, manager of creamery.	55	Andover, Lawrence, Woburn and Boston.
Andover, Shattuck Farms,	F. Shattuck, owner and manager.	50	Lawrence.
Auburn, Wellswood Farm,	George O. Keep, owner and manager.	30	Worcester.

List of Massachusetts Farms making Milk of Superior Quality and Cleanliness and selling their Product higher than the Regular Market Price — Continued.

LOCATION, FARM.	Owner and Manager.	Approximate Number of Cows.	Where marketed.
Barnstable, Bay Farm, . . .	H. C. Everett, owner and manager.	–	Barnstable.
Barre, Highland View Farm, . .	D. A. Howe, owner; W. E. Howe, manager.	25	Worcester.
Beverly, George R. Wales' farm, .	George R. Wales, owner and manager.	20	Beverly.
Bolton, Rocky Dundee Farm, .	R. H. Randall, lessee and manager.	20	Clinton.
Bolton, Wataquodock Farm, . .	Paul Cunningham, owner and manager.	35	Boston and vicinity, by Alden Brothers Company.
Boston, Walker-Gordon Farm, 1106 Boylston Street.	Walker-Gordon Laboratory Company, owner; John Nichols, manager.	100	Boston and vicinity.
Brimfield, Clarence B. Brown's farm.	Clarence B. Brown, owner and manager.	21	West Warren.
Brockton, Montello Station, Dutchland Farm.	Fred F. Field, owner; Earl D. Upton, manager.	70	Brockton.
Brookline, Louis Cabot estate, .	Louis Cabot, owner; R. Barkhouse, manager.	10	Brookline.
Chilmark, West Tisbury, P. O. Oakview Farm.	J. F. Adams, owner and manager.	17	Vineyard Haven and Edgartown.
Dighton, Rock Farm, . . .	J. W. Earle, owner; Ralph Earle, manager.	15	Fall River.
Dorchester, Codman Farm, . .	Watson B. Fearing, owner and manager.	125	Boston.
East Lynn, ...	J. D. Coombs, lessee and manager.	3	East Lynn.
East Walpole, Lewis Farm, . .	Geo. A. Plympton, owner,	80	Boston and vicinity, by Alden Brothers Company.
Everett, Joseph H. Cannell's farm,	Joseph H. Cannell, owner and manager.	7	Everett.
Everett, Thomas F. Leavitt's farm,	Thomas F. Leavitt, owner and manager.	8	Everett.
Fairhaven, Dana Farm, . . .	Eliza N. and Edith Dana, owners and managers.	52	Fairhaven, Marion and Mattapoisett (in summer).
Fairhaven, Lewis F. Blossom's farm,	Lewis F. Blossom, owner and manager.	12	Fairhaven.
Framingham, Millwood Farm, .	Mrs. E. F. Bowditch, owner; J. P. Bowditch, manager; F. E. Barrett, superintendent.	178	Boston and Wellesley.
Framingham, Waverney Farm, .	Reginald W. Bird, owner; A. E. White, manager.	50	Boston.
Framingham, Cherry Meadow Farm.	D. M. and E. F. Belches, owners; E. F. Belches, manager.	35	Framingham.
Franklin, Ray Farm, . . .	E. K. Ray estate, owner; Joseph G. Ray, trustee and manager.	100	Boston, by Elm Farm Company.
Gardner, Lakeside Farm, . .	J. Henry Ware, owner and manager.	7	Gardner.
Gardner, Otto Wickman's farm, .	Otto Wickman, owner and manager.	5	Gardner.
Gloucester, Howard P. Lane's farm,	Howard P. Lane, owner and manager.	50	Gloucester.
Gloucester, H. Wallace Lane's farm,	H. Wallace Lane, owner and manager.	30	Gloucester.
Gloucester, Peter Hagstrom's farm,	Peter Hagstrom, owner and manager.	5	Gloucester.
Granby, C. W. Ball's farm, . .	C. W. Ball, owner and manager.	29	Holyoke.

List of Massachusetts Farms making Milk of Superior Quality and Cleanliness and selling their Product higher than the Regular Market Price — Continued.

LOCATION, FARM.	Owner and Manager.	Approximate Number of Cows.	Where marketed.
Greenfield, Wayside Farm, . .	Frank H. Reed, owner; Mr. Purrington, manager.	25	Greenfield.
Groton, G. W. Greenhalge's farm, .	G. W. Greenhalge, owner and manager.	25	Boston and vicinity, by D. Whiting & Sons.
Hamilton, Miles River Farm, .	Maxwell Norman, owner and manager; C. E. Johnson, superintendent.	60	Boston.
Hardwick, Mixter Farm, . .	Mary A. Mixter, owner; Dr. Samuel J. Mixter, manager; S. R. Parker, superintendent.	200	Boston.
Haverhill (Bradford District), J. B. Sawyer's farm.	J. B. Sawyer, owner and manager.	–	Haverhill.
Haverhill (Bradford District), Cedar Crest Farm.	C. Herbert Poore, owner and manager.	20	Haverhill.
Haverhill, North Broadway Milk Farm.	E.A.Emerson, owner and manager.	35	Haverhill.
Haverhill (P. O. East Haverhill), Fred Kimball's farm.	Fred Kimball, owner; Leonard Kimball, manager.	35	Haverhill.
Holyoke, Whiting Farm, . .	W. F. Whiting, owner; John F. Richardson, manager.	20	Holyoke.
Kingston, Miss Helen Holmes' farm,	Miss Helen Holmes, owner and manager.	20	Kingston.
Lee, John Goodrich's farm, . .	John Goodrich, owner and manager.	40	Lee.
Leominster, Boutelle Farm, . .	E. H. Boutelle, owner and manager.	30	Leominster.
Leominster, Sholan Farm, . .	Paul Washburn, owner; A. G. Hollquist, manager.	40	Leominster.
Longmeadow, Hillbrow Farm, .	H. M. Burt, owner and manager.	20	Springfield.
Lowell, Hood Farm, . . .	C. I. Hood, owner; J. E. Dodge, manager.	120	Lowell.
Ludlow, E. E. Chapman's farm, .	Edward E. Chapman, owner and manager.	22	Ludlow and Indian Orchard.
Lunenburg, Sunnyside Farm, .	George M. Proctor, owner; Fred A. Miller, manager.	48	Fitchburg.
Lynnfield, N. F. McCarthy's farm,	N. F. McCarthy, owner; Eben Holmes, manager.	30	Wakefield.
Marlborough, Fairview Farm, .	Elmer D. Howe & Son, owners and managers.	10	Marlborough.
Medford, Mystic Valley Farm, 75 Arlington Street.	John J. Mulkevin, owner and manager.	16	Medford.
Medford, Hillside Farm, 20 Gow Street.	Alberton Harris, owner and manager.	10	Medford.
Methuen, Bragdon Farms, . .	E. L. Bragdon, owner and manager.	30	Lawrence.
Methuen, Cox Farms, . . .	Louis Cox, owner; L. Coburn, manager.	31	Lawrence.
Methuen, Howe Farm, . . .	E. D. Taylor, owner and manager.	50	Lawrence.
Methuen, Spring Valley Farms, .	Fred Miller, owner and manager.	50	Lawrence.
Methuen, S. W. Williams' farm, .	S. W. Williams, owner and manager.	30	Lawrence.
Millis, Lowland Farm, . . .	E. F. Richardson, owner and manager.	25	Boston.

List of Massachusetts Farms making Milk of Superior Quality and Cleanliness and selling their Product higher than the Regular Market Price — Continued.

LOCATION, FARM.	Owner and Manager.	Approximate Number of Cows.	Where marketed.
Milton, Highland Farm,	Patriquin & Newton, lessees; George Patriquin, manager.	65	Milton.
Needham, K. E. Webb's farm,	Kenneth E. Webb, owner and manager.	31	Needham.
Newton (P. O. Waban), W. B. McMullin's farm.	William B. McMullin, owner and manager.	17	Needham and Newton.
Newtonville, Willow Farm, 120 Farwell Street.	D. F. Smith, owner and manager.	48	Newton, Brookline and Boston.
Norfolk, Meadowside Farm,	T. D. Cook & Co., owners and managers.	35	Boston.
North Amherst, The Elms,	R. D. Dickinson, owner and manager.	30	Amherst.
North Attleborough, Halliday Farm,	Fred F. Halliday, owner; Robert C. Halliday, manager.	9	Pawtucket, R. I.
North Falmouth, Manuel G. White's farm.	Manuel G. White, owner and manager.	6	North Falmouth.
North Grafton, Bonnybrook Farm,	Everett N. Kearney, owner and manager.	60	Worcester.
North Tewksbury, Mountjoy,	Miss Florence Nesmith, owner; C. E. Lougee, manager.	50	North Tewksbury.
Northampton, W. J. LaFleur's farm,	W. J. LaFleur, owner and manager.	11	Northampton.
Oak Bluffs, Woodsedge Farm,	F. W. Chase, owner and manager.	20	Oak Bluffs.
Paxton, E. G. Richard's farm,	E. G. Richards, owner and manager.	40	Worcester, by C. Brigham Company.
Paxton, Echo Farm,	W. J. Woods, owner; Joseph Graham, manager.	40	Worcester, by C. Brigham Company.
Pepperell, George Shattuck's farm,	George Shattuck, owner and manager.	75	Boston and vicinity, by D. Whiting & Sons.
Pittsfield, Abby Lodge,	A. W. Cooley, owner; Mr. Carlson, manager.	35	Boston.
Pittsfield, Mr. Bardwell's farm,	Mr. Bardwell, owner and manager.	14	Pittsfield.
Pittsfield, E. W. Page's farm,	E. W. Page, owner and manager.	8	Pittsfield.
Revere, Mrs. M. L. Mahoney's farm,	Mrs. M. L. Mahoney, owner; J. J. Mahoney, manager.	25	Malden.
Saugus, Oaklandvale Farm,	Frank P. Bennett, owner and manager.	112	Lynn.
South Lincoln, South Lincoln Dairy Company.	South Lincoln Dairy Company, owner; W. A. Blodgett, manager.	220	Boston, Cambridge and Brookline.
South Natick, Carver Hill Farm,	Carver Hill Farms, Inc., Austin Potter.	75	Wellesley, Boston, Natick, Needham and Dover.
Southville, Waumesit Farm,	R. F. Parker, owner and manager.	20	Boston and vicinity, by C. Brigham Company.
Sherborn, H. N. Brown's farm,	H. N. Brown, owner and manager.	50	Boston.
Sherborn, Dexter Farm,	George T. Dexter, owner and manager.	23	Boston and vicinity, by Alden Brothers Company.
Sherborn, J. M. Merriam's farm,	J. M. Merriam, owner and manager.	40	Boston.
Sterling, Twin Oaks Farm (P. O. Pratt's Junction).	James F. Pratt, owner and manager.	75	Milk, Boston; cream, Worcester.

List of Massachusetts Farms making Milk of Superior Quality and Cleanliness and selling their Product higher than the Regular Market Price — Concluded.

LOCATION, FARM.	Owner and Manager.	Approximate Number of Cows.	Where marketed.
Stoughton, Tobey Farm, . .	E. B. Hutchins, owner and manager.	15	Brockton.
Taunton, George Soper's farm, .	George Soper, owner and manager.	30	Taunton.
Waltham, Pleasantdale Farm, .	C. U. Hubbard, owner and manager.	35	Weston.
Wayland, Perkins' Estate, . .	S. N. Sanders, manager, .	12	Waltham.
Westfield, Woronoak Farm, . .	Edgar L. Gillett, owner; N. J. Weidhaas, manager.	12	Westfield.
Weston, Charles Merriam's farm, .	Charles Merriam, owner and manager.	51	Waltham.
Westwood, Fox Hill Farm, . .	Joshua Crane, owner; L. W. Jackman, manager.	100	Boston.
West Newton and Barre, Wauwinet Farm.	George H. Ellis, owner; P. F. Staples and R. M. Handy, managers.	400	Boston, Brookline and Newton.
Warren, Maple Farm, . . .	J. R. Blair, owner and manager.	27	Boston, by C. Brigham Company.
Woburn, John Day's farm, . .	John Day, owner and manager.	18	Winchester.
Worcester, Pleasant View Farm, .	Warren C. Jewett, owner and manager.	40	Worcester.
Worcester, Lewis J. Kendall's farm,	Lewis J. Kendall, owner and manager.	40	Worcester.
Worcester, Intervale Farm, . .	J. Lewis Ellsworth, owner and manager.	14	Worcester.
Worcester, Village Farm, . .	H. B. Prentice, owner and manager.	30	Worcester.

NOTE. — Deerfoot Farm Dairy, office 9 Bosworth Place, Boston, with milk depots at both Southborough and Northborough, sells milk of superior quality and cleanliness at a price above that of ordinary market milk, and handles the product of 129 dairy farms, averaging about 10 cows each, located in Southborough, Northborough, Westborough and Holliston. Most of these farms, therefore, at some time during the year come properly within the requirements of this list.

List of Massachusetts Dairy Farms making Certified Milk.

NAME, LOCATION.	Owner and Manager.	Approximate Number of Cows.	Certified by —	Where marketed.
Cedar Hill Farm, Waltham,	Miss Cornelia Warren, owner; Charles Cahill, manager.	215	Cambridge Medical Commission.	Waltham, Cambridge, Boston.
Cedar Crest Farm, Waltham.	John C. Runkle, owner; Louis W. Dean, manager.	90	Cambridge Medical Commission.	North Shore, Cambridge, Boston.
Cherry Hill Farm, Beverly,	H. P. Hood & Sons, owners; O. H. Perrin, managers.	80	Medical Milk Commission of Boston.	Boston, North Shore, Lawrence.
A. D. Davis' farm, Sheffield,	A. D. Davis, owner and manager.	60	- -	Some in Great Barrington; balance outside of State.
Indian Bridge Farm, Wayland.	Edmund H. Sears, owner; Walter Jauncey, Jr., manager.	16	Cambridge Medical Milk Commission.	Waltham.
Ledyard Farm, Andover, .	J. A. & W. H. Gould, owners and managers.	50	Malden Medical Commission.	Malden.
Massachusetts Agricultural College Farm, Amherst.	Massachusetts Agricultural College, J. A. Foord.	65	Medical Milk Commission of Boston.	Boston.
Oaks Farm, Cohasset, .	C. W. Barron, owner; W. E. Stilwell, manager.	50	Medical Milk Commission of Cohasset.	Cohasset.
Oliver Prescott's farm, Dartmouth (P. O. North Dartmouth).	Oliver Prescott, owner; Harry W. Martin, manager.	20	New Bedford Medical Commission.	New Bedford.
Prospect Hill Farm, Essex,	J. A. & W. H. Gould, owners and managers.	175	Medical Milk Commission of Boston.	Boston, Brookline, Jamaica Plain, North Shore.
Seven Gates Farm, North Tisbury.	W. L. Webb, owner; O. L. Curtis, manager.	20–25	Medical Milk Commission of West Tisbury, Inc.	Martha's Vineyard.
Walter A. White's farm, Acushnet.	Walter A. White, owner and manager.	30	New Bedford Medical Commission.	New Bedford.

LIST OF LOCAL MILK INSPECTORS.

Milk Inspectors for Massachusetts Cities, 1914.

Attleboro, ...	Caleb E. Parmenter.
Beverly, ...	Henry E. Dodge, 2d.
Boston, ...	Prof. James O. Jordan.
Brockton, ...	George E. Bolling.
Cambridge, ...	Dr. W. A. Noonan.
Chelsea, ...	Dr. W. S. Walkley.
Chicopee, ...	C. J. O'Brien.
Everett, ...	E. Clarence Colby.
Fall River, ...	Henry Boisseau.
Fitchburg, ...	John F. Bresnahan.
Gloucester, ...	Dr. G. E. Watson.
Haverhill, ...	Dr. Homer L. Conner.

Holyoke,	Daniel P. Hartnett.
Lawrence,	Dr. J. H. Tobin.
Lowell,	Melvin F. Master.
Lynn,	George A. Flanagan.
Malden,	J. A. Sandford.
Marlborough,	John J. Cassidy.
Medford,	Winslow Joyce.
Melrose,	R. N. Hoyt.
New Bedford,	Herbert Hamilton, D.V.S.
Newburyport,	Dr. R. D. Hamilton.
Newton,	Arthur Hudson.
North Adams,	Henry A. Tower.
Northampton,	George R. Turner.
Pittsfield,	Bernard M. Collins, V.M.D.
Quincy,	Daniel Scourler.
Revere,	Joseph E. Lamb, M.D.
Salem,	John J. McGrath.
Somerville,	Herbert E. Bowman.
Springfield,	Stephen C. Downs.
Taunton,	Lewis I. Tucker.
Waltham,	Arthur L. Stone, M.D.
Woburn,	Edward P. Kelly, M.D.
Worcester,	Gustaf L. Berg.

Milk Inspectors for Massachusetts Towns, 1914.

Adams,	Dr. A. G. Potter.
Amesbury,	J. L. Stewart.
Andover,	Franklin H. Stacey.
Arlington,	Dr. L. L. Pierce.
Athol,	John H. Meaney.
Barnstable,	George T. Mecarta.
Belmont,	Thomas F. Harris.
Brookline,	W. E. Ward.
Canton,	R. N. Hoyt.
Clinton,	Gilman L. Chase.
Cohasset,	D. W. Gilbert, D.V.S.
Concord,	Joseph Dee, Jr.
Dedham,	Edward Knobel.
Easthampton,	George L. McEvoy.
Fairhaven,	Bertha F. Carl Frommell, M.D.
Framingham,	R. N. Hoyt.
Gardner,	Clifford W. Shippee.
Greenfield,	George P. Moore.
Hudson,	William H. Clark.
Lancaster,	George E. Howe.
Leominster,	William H. Dodge.
Ludlow,	A. L. Bennett, D.V.S.

Marblehead,	Andrew W. Stone.
Middleborough,	Dr. William H. Haskell.
Millbury,	Arthur A. Brown.
Milton,	W. C. Tucker.
Monson,	Dr. E. W. Capen.
Needham,	R. N. Hoyt.
North Attleborough,	Hugh Gaw, V.S.
Palmer,	Edward P. Brown.
Peabody,	H. S. Pomeroy, M.D.
Plainville,	John C. Eiden.
Reading,	C. H. Playden, M.D.
Salisbury,	John F. Pike.
Sandwich,	J. E. Holway.
Southbridge,	Albert R. Brown.
South Hadley Falls,	George F. Boudreau.
Spencer,	James A. Spencer.
Stoneham,	William M. Balmer.
Swampscott,	Herbert D. Smith.
Wakefield,	Harry A. Simmonds.
Ware,	Fred E. Marsh.
Watertown,	R. N. Hoyt.
Wellesley,	R. N. Hoyt.
Westborough,	Charles H. Reed.
Westfield,	William H. Porter.
Weston,	R. N. Hoyt.
West Springfield,	Norman T. Smith.
Williamstown,	G. S. Jordan, V.S.
Winchendon,	Dr. G. W. Stanbridge.
Winchester,	Maurice Dinneen.
Winthrop,	Smith A. Mowry.

CREAMERIES, MILK DEPOTS, ETC.

Co-operative Creameries.

NUMBER AND LOCATION.	Name.	Superintendent or Manager.
1. Ashfield,	Ashfield Creamery,	William Hunter, manager.
2. Belchertown,	Belchertown Creamery,	M. G. Ward, president.
3. Cummington,	Cummington Creamery,	D. C. Morey, superintendent.
4. Easthampton,	Easthampton Creamery,	E. B. Clapp, treasurer.
5. Egremont (P. O. Great Barrington).	Egremont Creamery,	E. G. Tyrell, manager.
6. Monterey,	Berkshire Hills Creamery,	F. A. Campbell, treasurer.
7. Northfield,	Northfield Creamery,	C. C. Stearns, treasurer.
8. Shelburne,	Shelburne Creamery,	Ira Barnard, manager.
9. Westfield,	Wyben Springs Creamery,	C. H. Kelso, manager.

Proprietary Creameries.

Number and Location.	Name.	Owner or Manager.
1. Amherst, ...	Amherst Creamery Company, .	R. W. Pease, manager.
2. Amherst, ...	Fort River Creamery, . .	Clarence M. Wood, manager (estate of E. A. King, owner).
3. Brimfield, ...	Crystal Brook Creamery, . .	F. N. Lawrence, proprietor.
4. Great Barrington, . .	Edgewood Creamery, . .	C. W. Freehan, manager.
5. Heath, ...	Cold Spring Creamery, . .	I. W. Stetson & Son.
6. Hinsdale, ...	Hinsdale Creamery, . . .	Walter C. Solomon, proprietor.

Educational.

Location.	Name.	Manager.
Amherst, ...	Dairy Industry Course, Massachusetts Agricultural College.	W. P. B. Lockwood, professor in charge.

Principal Milk-distributing Depots.

Name.	Location.	Manager.
Acton Farms Milk Company, .	Somerville, Windsor Street, . .	Arthur B. Parker, treasurer.
Alden Brothers Company, .	Boston office, 1171 Tremont Street; depot, 24-28 Duncan Street.	Charles L. Alden, president; John Alden, treasurer.
Anderson Brothers, . . .	Worcester, Eckman Street, . .	Anderson Brothers.
Boston Ice Cream Company, .	Roxbury, 40 King Street, . .	Harry M. Hardwick, president and treasurer.
Boston Jersey Creamery, .	Boston, 9 Fulton Street, . .	Theo. P. Grant, president and manager.
Brigham, C., Company, . .	Cambridge, 158 Massachusetts Avenue.	John K. Whiting.
Brigham, C., Company, . .	Worcester, 9 Howard Street, . .	C. Brigham Company.
Bristol Creamery Company, .	Boston, 132 Central Street, . .	William L. Johnson.
Columbia Creamery, . .	Springfield, 117 Lyman Street, .	H. A. Mosely.
Deerfoot Farms Dairy, . .	Boston, 132 Central Street; depots at Northborough and Southborough.	S. H. Howes.
Elm Farm Milk Company, .	Boston, Wales Place, . . .	James H. Knapp, treasurer.
Franklin Creamery Company,	Boston, 147 Harrison Avenue, .	Tait Brothers.
Hampden Creamery Company,	Everett, Orient Avenue, . .	Frank H. Adams, treasurer.
Hood, H. P., & Sons, . .	Boston, 494 Rutherford Avenue; branches, 24 Anson Street, Forest Hills; 886 Broadway, Chelsea. Lynn, 193 Alley Street. Malden, 425 Main Street. Watertown, 479 Pleasant Street. Lawrence, 629 Common Street.	Charles H. Hood.

Principal Milk-distributing Depots — Concluded.

NAME.	Location.	Manager.
Learned, G. S. (Fitchburg Creamery).	Fitchburg, 26 Cushing Street, .	G. S. Learned.
Lyndonville Creamery Association.	Watertown, 86 Elm Street, . .	Willis C. Conner, manager.
Nash, Charles A., ...	Springfield, 120 Oakland Street, .	Charles A. Nash, manager.
Newhall, J. A., ...	Newburyport, 32 Monroe Street, .	J. A. Newhall.
Perry, A. D., ...	Worcester, Kansas Street, . .	A. D. Perry.
Plymouth Creamery Company,	Boston, 268–270 State Street, . .	John W. Davies.
Prentice, H. H., & Co. (Berkshire Creamery).	Pittsfield, Crane Avenue, . .	H. H. Prentice.
Rockingham Milk Company, .	Charlestown, Boston office, Hancock Square; depot 330 Rutherford Avenue.	Rolan H. Toothaker, president.
Somers Creamery Company, .	Springfield, 178 Dwight Street, .	W. M. Cushman.
Springfield Creamery, . .	Springfield, Main Street, . .	F. B. Allen, proprietor.
Tait Brothers, ...	Springfield, 37 Vinton Street, .	Tait Brothers, proprietors.
Turner Centre Dairying Association.	Boston office, 63, 67 and 69 Endicott Street.	Irven L. Smith, manager.
Wachusett Creamery, . .	Worcester, 6 Lincoln Street, . .	E. H. Thayer & Co., proprietors.
Whiting, D., & Sons, . .	Boston, 570 Rutherford Avenue, .	George Whiting.

Milk Laboratory.

Walker-Gordon Laboratory, .	Boston, 1106 Boylston Street, .	George W. Franklin.

Receiving Depot for Milk, for Shipments to New York City.

Willow Brook Dairy Company,	Sheffield, ...	Frank Percy.

ENCOURAGEMENT OF PRACTICAL DAIRYING EXPENSES, MARCH TO NOVEMBER.

Agents, expenses, ...	$849 03
General agent, traveling and necessary expenses, ...	544 88
Judge, compensation, ...	50 00
Printing, photography, postage and supplies, ...	196 47
Clerical assistance, ...	3 60
Total, ...	$1,643 98
Prizes, ...	3,735 30
Total expenditures, ...	$5,379 28

REGULAR BUREAU EXPENSES.

The following is a classified statement of the expenses for the year ending November 30, 1914: —

Bureau, compensation and traveling expenses,	$761 86
Agents, compensation,	2,988 66
Agents, traveling expenses and samples purchased,	2,093 63
General agent, traveling and necessary expenses,	213 59
Analysts, analyses, tests, court attendance,	686 00
Printing, photography, postage and supplies,	913 97
Clerical assistance,	339 95
Total,	$7,997 66

P. M. HARWOOD,
General Agent.

Accepted and adopted as the report of the Dairy Bureau.

CHAS. M. GARDNER.
GEORGE W. TRULL.
OMER E. BRADWAY.

REPORT

ON THE

ENCOURAGEMENT OF DAIRYING CONTESTS,

1914.

ENCOURAGEMENT OF DAIRYING PRIZE CONTESTS, 1914.

P. M. HARWOOD, GENERAL AGENT, DAIRY BUREAU.

Prizes offered.

Class 1. Clean Milk Contest.

Cleanliness determined by sediment test. State divided into four districts, viz., western, central, northeastern and southeastern. Prizes offered in each district: —

(*a*) Open to practical dairymen who manage their own farms and own five or more cows. Prizes aggregating $2,640, or $660 in each district, were offered.

Additional Prizes. — Sweepstakes prize for entire State, $100; district with largest number of entries, $125; district making best showing of clean milk, $100.

(*b*) Junior prizes offered to persons under eighteen years of age, — sons, daughters, protégés or actual employees of the owners of farms eligible in (*a*). Prizes aggregating $264, or $66 in each district, were offered.

Additional Prize. — Sweepstakes ribbon for entire State.

(*c*) Hired help prizes offered to persons over eighteen years of age, — employees on farms eligible in (*a*). Prizes aggregating $160, or $40 in each district, were offered.

Additional Prize. — Sweepstakes ribbon for entire State.

Class 2.

Prize of $100 for the best system of dairy-farm accounting was offered. Competition open to the world.

Class 3.

Prizes for systems of dairy-farm accounting in actual operation. Competition open to farms eligible in Class 1 (*a*). Three prizes aggregating $200 were offered.

Class 4.

Prize of $100 for the best plan of a practical dairy barn was offered. Competition open to the world.

Class 5.

Prizes aggregating $200 for the best practical dairy barns in actual use were offered. Competition open to farms eligible in Class 1 (*a*).

Class 6.

Prizes aggregating $450 for dairy-farm operations were offered. Competition open to farms eligible in Class 1 (*a*).

RESULTS.

In Class 1 (*a*), western district, there were 71 entries; (*b*), 7 entries; and (*c*), 11 entries. The winners were as follows: —

Class 1 (a).

First to fourth tied: —
- Henry S. Ashley, East Longmeadow.
- William H. Atkins, Amherst.
- Peter Kronvall, East Longmeadow.
- Sylvester Spellman, East Longmeadow.

Fifth to twelfth tied: —
- Felix Bobart, Wilbraham.
- Clarence B. Brown, Brimfield.
- Harry M. Burt, Longmeadow.
- Laurens Clark, Montgomery.
- Carl A. Johnson, East Longmeadow.
- Charles H. Kelso, Westfield.
- Clinton F. Markham, East Longmeadow.
- Charles J. Nelson, Agawam.

Thirteenth to twenty-fifth tied: —
- George E. Hale, Tyringham.
- Asa N. Hayes & Robert H. Downey, Hampden.
- Mrs. Hilda Hall, Hampden.
- Frank G. Hulett, East Longmeadow.
- Hermon W. King, East Longmeadow.
- Patrick J. Landers, Belchertown.
- George E. Lowry, Williamstown.
- Dana S. Moore, West Springfield.
- William H. Morey, Cummington.

Thirteenth to twenty-fifth tied — *Concluded.*
- Per Persson, East Longmeadow.
- F. J. Pomeroy & Son, Agawam.
- Randall Bros., Agawam.
- John B. Walker, Orange.

Honorable mention: —
- Orus E. Parker, Brimfield.
- John W. McDermott, Monson.
- John J. Flynn, Hampden.
- L. F. Griggs, East Longmeadow.
- William S. Pearsall, Brimfield.
- William S. Christopher, East Longmeadow.
- Benjamin B. Green, Wilbraham.
- Isador A. Ricard, Hampden.
- Lee S. Jenks, Agawam.
- Lewis N. Oakes, Clarksburg.
- Leon A. Jewell, North Wilbraham.
- John J. Reilly, Agawam.
- Sumner C. Schwartz, Agawam.
- Elmer E. McIntire, Feeding Hills.
- Frank Mazars, West Springfield.
- Irvin L. Thompson, Springfield.
- Reid Bros., East Longmeadow.
- David Witto, Clarksburg.
- Stanislaw Jackowski, Agawam.
- George Chestnut, East Longmeadow.
- Oscar C. Pomeroy, Longmeadow.
- Edwin A. Parker, Agawam.
- Myron B. Avery, Montgomery.
- Harrison S. Williams, West Springfield.
- Kibbe Bros., Hampden.

Class 1 (b). Juniors.

First prize, Axel G. Larson, Hampden.
Second prize, Pauline C. Persson, East Longmeadow.
Third prize, Arnold B. Hale, Tyringham.
Fourth prize, Harry W. King, East Longmeadow.
Fifth prize, Clifford Tiffany, Amherst.
Sixth prize, Clifton B. Green, Wilbraham.

Class 1 (c). Hired Help.

First prize, Herbert R. Cowles, Westfield.
Second prize, John Smith, Brimfield.
Third prize, Arthur B. Yah, East Longmeadow.
Fourth prize, Charles Mazars, West Springfield.
Fifth prize, Thomas J. Conley, Cummington.

In Class 1 (*a*), central district, there were 89 entries; (*b*), 11 entries; and (*c*), 21 entries. The winners were as follows: —

Class 1 (*a*).

First prize, Albion G. Smalley, West Boylston.
Second prize, Louis N. Malhoit, Sutton.
Third prize, John C. Summ, Lancaster.
Fourth prize, Olie A. Tuttle, Hardwick.
Fifth prize, Henry N. Granger, West Auburn.
Sixth prize, Alphonso E. Brown, Lunenburg.
Seventh prize, C. Bertram Epps, Winchendon.
Eighth prize, Clifford R. Harris, Millbury.

Ninth to nineteenth tied: —
  Dana L. Brooks, Worcester.
  M. Anna Cleveland, Hardwick.
  John G. Henry, M.D., Winchendon.
  Charles A. Heywood, Gardner.
  Edwin B. Mellen, Winchendon.
  Francis E. Morlock, Winchendon.
  Marcus M. Paine, West Millbury.
  William C. Pierce, West Boylston.
  George F. Smith, Barre.
  Frank C. Smith, North Leominster.
  Otto Wickman, Gardner.

Twentieth prize, Arthur G. Goodfield, New Braintree.
Twenty-first prize, George N. Perry, Sutton.
Twenty-second prize, Moses L. Stotler, Lancaster.
Twenty-third prize, James Brown, Lunenburg.
Twenty-fourth prize, Charles A. Bowker, Worcester.
Twenty-fifth prize, Jacob Anderson, Gardner.

Honorable mention: —
  David C. Grosvenor, Auburn.
  Cora L. Rice, Gardner.
  Arthur W. Cutler, West Brookfield.
  Albert L. Woodis, North Brookfield.
  Joseph W. Clark, West Brookfield.
  John Nygard, Templeton.
  Everett N. Kearney, North Grafton.
  James W. Robbins, West Boylston.
  Charles E. Brown, Gardner.
  Marchant M. Martin, Southborough.
  Charles Carlstrom, Millbury.
  Edward Warren, Leicester.

Honorable mention — *Concluded.*

Joseph S. Hillman, Hardwick.
Frank J. Berry, Hardwick.
Axel Berg, Lunenburg.
Rufus H. Randall, Bolton.
Anna H. Whitney, Lancaster.
George I. Stowe, West Millbury.
John Navaroli, West Boylston.
Louis J. Kendall, Worcester.
David J. Welsh, Sutton.
Louis Matson, Millbury.
Yahn Bergstram, West Millbury.
Charles T. Gunn, Brookfield.
Albert L. Hauck, West Boylston.
Antoine J. Couillard, Hubbardston.
Burt Trook, Westborough.
William R. Burgess, Auburn.
George O. Keep, Auburn.
J. Henry Ware, Gardner.

Class 1 (b). Juniors.

First prize, Edward McGrath, West Millbury.
Second prize, L. Stanley Heywood, Gardner.
Third prize, Howard L. Jordan, Holden.
Fourth prize, Walter B. Shaw, Sutton.
Fifth prize, Edwin Carlstrom, Millbury.
Sixth prize, Willis McConnell, Hardwick.

Class 1 (c). Hired Help.

First prize, Harry S. Granger, Auburn.
Second prize, Cabot R. Brewster, Hardwick.
Third prize, Rolland Spofford, Winchendon.
Fourth prize, John F. O'Neil, Worcester.
Fifth prize, Joseph Przybylski, New Braintree.

In Class 1 (*a*), northeastern district, there were 37 entries; (*b*), 2 entries; and (*c*), 11 entries. The winners were as follows: —

Class 1 (a).

First prize, Albin Spyut, Ipswich.
Second prize, Agostino Visocchi, Sudbury.
Third prize, Ernest W. Burks, Natick.
Fourth prize, Albert Elwell, Ipswich.
Fifth prize, Fred Miller, Methuen.
Sixth prize, Edwin Ilsley, Newbury.

Seventh prize, Charles F. Bisbee, Haverhill.
Eighth prize, Bryant Bros., Dracut.
Ninth prize, Stuart L. Little, Newbury.
Tenth prize, William J. Cameron, Ipswich.
Eleventh prize, Peter Hagstrom, Gloucester.
Twelfth prize, Crosby & Flitner, Billerica.
Thirteenth prize, Aaron Osterman, Tewksbury.
Fourteenth prize, John H. Ahola, Lanesville.
Fifteenth prize, Edward M. Nason, Haverhill.
Sixteenth prize, John Day, Woburn.
Seventeenth prize, William B. McMullin, Newton.
Eighteenth prize, William C. Knight, Newbury.
Nineteenth prize, George B. Clark, Concord.
Twentieth prize, James A. Noyes, Newbury.
Twenty-first prize, John T. Faughnan, Newburyport.
Twenty-second prize, Clifford C. Steele, Stoneham.
Twenty-third prize, George W. Lunt, Newbury.
Twenty-fourth prize, Oliver J. Coburn, Dracut.
Twenty-fifth prize, Leblanc Bros., Dracut.

Class 1 (b). Juniors.

First prize, Albert Nason, Haverhill.
Second prize, Albert E. Elwell, Ipswich.

Class 1 (c). Hired Help.

First prize, Paul Nason, Haverhill.
Second prize, Chester Cameron, Ipswich.
Third prize, Allen P. Pingree, Ipswich.
Fourth prize, Joseph Ralph, Newton.
Fifth prize, Austin K. Noyes, Newbury.

In Class 1 (*a*), southeastern district, there were 32 entries; (*b*), 2 entries; and (*c*), 11 entries. The winners were as follows: —

Class 1 (a).

First to fourth tied: —
    Harry L. Carpenter, Attleboro.
    Josiah Q. Packard, Brockton.
    Benjamin F. Paige, Hanson.
    Manuel G. White, North Falmouth.

Fifth to eighth tied: —
    George H. Gould, Taunton.
    John P. Howland, Taunton.
    John Quinn, Kingston.
    Kenneth E. Webb, Needham.

Ninth to twelfth tied: —
- John J. Rafter, Sharon.
- H. Arthur Standish, Middleborough.
- Edgar M. West, West Tisbury.
- George C. & William C. Wilkins, Plainville.

Thirteenth to twentieth tied: —
- Lewis F. Blossom, Fairhaven.
- Everett A. Bowen, Lakeville.
- Melvin O. Bradford, Acushnet.
- Michael J. Conway, Taunton.
- John Olson, Raynham.
- George Parker, Sandwich.
- Jose Pontes, Swansea.
- Harry O. White, New Bedford.

Twenty-first prize, John J. Lemaire, Taunton.
Twenty-second prize, John B. Souza, Taunton.
Twenty-third prize, Benjamin W. Shaw, Weymouth.
Twenty-fourth prize, Almon S. Tilton, Chilmark.
Twenty-fifth prize, Charles R. Neagus, North Dartmouth.

Class 1 (b). Juniors.

First prize, Leonard F. Lemaire, Taunton.

Class 1 (c). Hired Help.

First prize, George D. Paige, Hanson.
Second prize, Harry D. West, West Tisbury.
Third prize, Edward Quinn, Kingston.

Fourth to sixth tied: —
- Charles C. Bichterman, Middleborough.
- Charles H. Hilliard, Sandwich.
- William S. Taylor, Needham.

In the case of the sweepstakes prize of $100, five persons were tied for first position; therefore this prize could not be awarded. Upon recommendation of the judge, however, the money was equally distributed among the first four contestants of the western district and the first one of the central district.

The prize of $125 for the largest number of entries was awarded to the central district, and the money was equally distributed among the contestants ranking 26–50, inclusive.

The prize of $100 for the best showing of clean milk was equally divided between the western and central districts, and the money was equally distributed among the honorable mention contestants of each district.

In Class 1 (*b*) a sweepstakes ribbon was awarded to Axel G. Larson of Hampden.

In Class 1 (*c*) a sweepstakes ribbon was awarded to George D. Paige of Hanson.

In Class 2 there were 3 entries, but as the contestants showed little or no originality in the systems submitted, upon recommendation of the judge no prize was awarded.

In Class 3 there were 2 entries. The second prize of $60 was awarded to James F. Adams of West Tisbury, and the third prize of $40 was awarded to Clifford R. Harris of West Millbury. The first prize was not awarded.

In Class 4 there were 2 entries which resulted in a tie. The prize of $100 was equally divided between John H. J. Colcord of Melrose and Edwin C. Powell of Springfield.

In Class 5 there were 11 entries. The first prize of $100 was awarded to Elmer D. Howe & Son of Marlborough, the second prize of $60 to Edwin L. Boardman of Sheffield, and the third prize of $40 to Ernest W. Burks of Natick.

In Class 6 there was no competition.

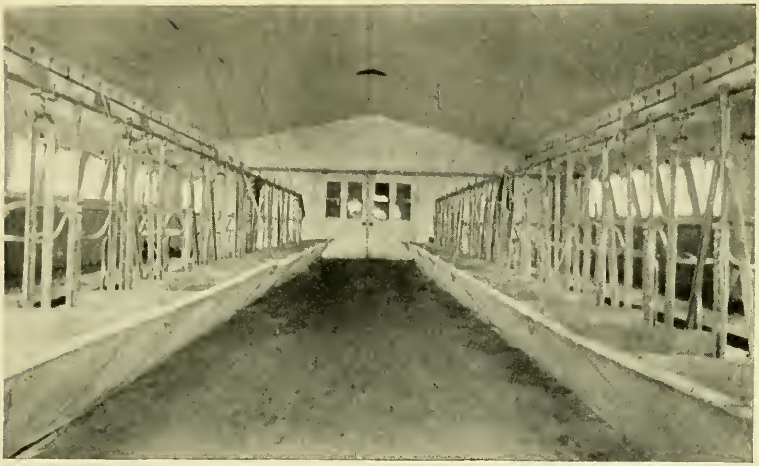
The judge in Class 1 was Simeon C. Keith of Massachusetts Institute of Technology, and in the other classes, James A. Foord of the Massachusetts Agricultural College.

Barn owned by Elmer D. Howe & Son, Marlborough. First prize.

Barn owned by E. L. Boardman, Sheffield. Second prize.

Barn owned by Ernest W. Burks, Natick. Third prize.

STABLES OF WINNERS IN PRIZE-BARN CONTEST.



Stable in first-prize barn.

Stable in second-prize barn.

Stable in third-prize barn.

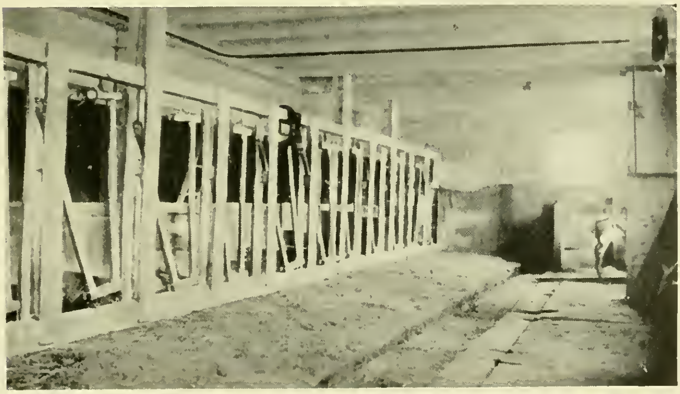
STABLES OWNED BY WINNERS IN CLEAN MILK CONTEST.

CENTRAL DISTRICT.

Stable owned by A. G. Smalley, West Boylston. Winner of first prize and one-fifth sweepstakes money.

WESTERN DISTRICT.

Stable owned by Henry S. Ashley, East Longmeadow. Tied for first place, and winner of one-fifth sweepstakes money.



WESTERN DISTRICT.

Stable owned by William H. Atkins, Amherst. Tied for first place, and winner of one-fifth sweepstakes money.

STABLES OWNED BY WINNERS IN CLEAN MILK CONTEST.

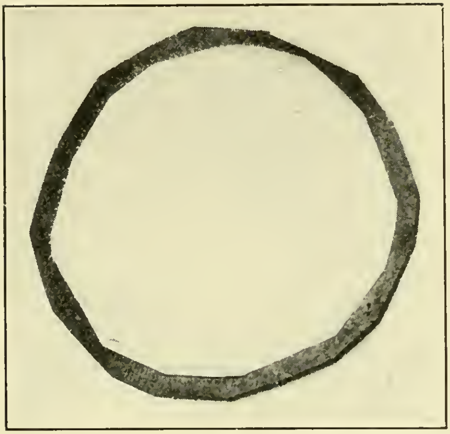
WESTERN DISTRICT.

Stable owned by Peter Kronvall, East Longmeadow. Tied for first place, and winner of one-fifth sweepstakes money. (Sweepstakes prize in 1913.)

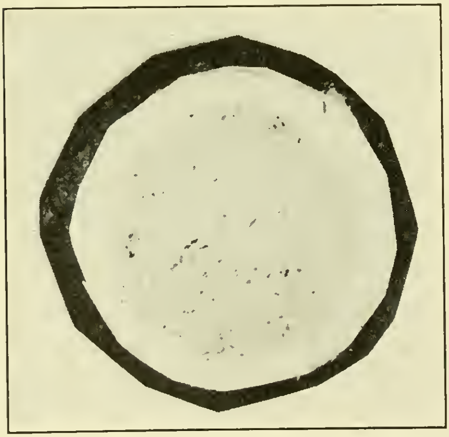
WESTERN DISTRICT.

Stable owned by Sylvester Spellman, East Longmeadow. Tied for first place, and winner of one-fifth sweepstakes money.

PHOTOGRAPHS OF SEDIMENT TEST COTTONS.



Cotton after a quart of clean milk has passed through it.



Cotton after a quart of unclean milk has passed through it.

FIRST ANNUAL REPORT

ON

BOYS' AND GIRLS' CLUB WORK.

FIRST ANNUAL REPORT ON BOYS' AND GIRLS' CLUB WORK.

Boys' and Girls' Clubs form an important branch of the educational efforts of the State Board of Agriculture, perhaps the most far-reaching in their results. These clubs have been under the direction of the Department of Agricultural Education of the Massachusetts Agricultural College since they were organized in 1908. Professor O. A. Morton and Miss Ethel H. Nash, members of the Extension Service of the college, are in charge of the field work. This consists in the promotion of interest among school officials and school patrons, civic and other organizations interested in the education of children and young people, giving advice and assistance in the organization of local clubs, training club leaders and directing their work. Some time is also devoted to the guidance of individual club members. This is especially true in regard to home economics, and, to a large extent, in corn, potato and market-garden enterprises where the larger areas are involved. Two field inspectors were employed during the latter part of the past summer who made personal inspection of and reports on individual enterprises.

ORGANIZATION.

The work of the Boys' and Girls' Club proceeds along two fairly distinct lines, — the Massachusetts Home and School Garden Club, and the Boys' and Girls' Agricultural Club. The Home and School Garden Club consists, for the most part, of boys and girls in the grammar grades of the schools. They cultivate quite small areas either at home or at school. Many of these children in the home gardens obtain a small quantity of seed from the college free. They are encouraged to display products in local competitive exhibits. These exhibits are entirely under the direction of local or home leaders. Many of the members display their products in the children's and youths' departments of the agricultural and horticultural societies of the State, under the general supervision of the State Board of Agriculture.

The other branch of the organization is known as the Boys' and Girls' Agricultural Club. This is made up, for the most part, of young people in the upper grammar grades and of high school age. The areas cultivated by members of this branch range from one-twentieth of an acre, as a minimum for market gardening, to one acre or over for corn growers. The market gardeners may grow any number of vegetables they choose. Other members of agricultural clubs concentrate their efforts more or less upon one main enterprise, such as corn growing, potato growing, egg production, hay production or work in home economics. In the promotion of these special lines there is strong emphasis placed on the desirability of doing a task worthy of the best efforts of a high-minded boy or girl. The competition in one of these self-imposed tasks, carried through under proper guidance, is recognized as a true achievement. Substantially all the work of the Boys' and Girls' Agricultural Club is on a competitive basis. Every one who enters this branch of the work does so with the understanding that he or she is in a contest competing for a substantial prize. The individual reaching the highest rank in market gardening, corn growing, potato growing, egg production, hay production or work in home economics is given a free trip to Washington, District of Columbia, lasting from three to four days. Two others, whose ranks come next in order, are given an educational trip about New England. Still others whose ranks indicate noteworthy and meritorious work are given a free week's outing at the Massachusetts Agricultural College. This may take the form of attendance at Farmers' Week, or a boys' camp at the college during the summer. In all cases it includes instruction, recreation, games and other diversions.

In addition to competing for the prizes just mentioned, all these members may and many of them do enter their products in the competitive exhibits of the children's and youths' departments of agricultural and horticultural societies. Occasionally, individuals of this group make entries and win prizes in com-

Cups awarded as sweepstake prizes in Home Economics, Market Gardening, Corn Growing and Potato Growing, 1914.

petition with adults. Competitors in corn growing and potato growing are required to exhibit samples. This, heretofore, has been done at the annual winter meeting of the State Board of Agriculture in December.

School Competitions.

Another feature of the organization consists of enlisting the co-operation of the public schools. This is done by means of cups and cash prizes awarded to the city, town or school which makes the best showing in the promotion and supervision of the whole field of club work, including both the Home and School Garden Club and the Boys' and Girls' Agricultural Club.

Finance.

The club work is financed in part from funds of the college appropriated for the Extension Service of the Massachusetts Agricultural College, in part from funds appropriated to the State Board of Agriculture, and in part by funds from the Federal government through the Bureau of Plant Industry of the Department of Agriculture. The funds derived from the Extension Service are devoted chiefly to the payment of salaries, travel and maintenance of the Home and School Garden Club. The funds obtained through the State Board of Agriculture go toward the payment of State premiums and awards in the Boys' and Girls' Agricultural Club, both for individual and group competitions, like cities, towns and schools. The State Board of Agriculture is granted a supplemental fund of $200 for each agricultural or horticultural society which draws State bounty. This fund is devoted entirely to the payment of awards to children and youths under eighteen years of age for agricultural and other products. The funds from the Federal government are used for the payment of salaries and traveling expenses of persons engaged in the promotion and direction of the Boys' and Girls' Agricultural Club. The funds from all these sources for all features of the club work amounted in 1914 to something like $12,000 or $13,000. This includes salaries of two persons, traveling expenses, printing, premiums and incidental expenses.

IMPORTANT FEATURES OF THE YEAR'S WORK.

Growth.

Continued interest in this phase of agricultural teaching is shown by increased growth in the club membership. During the past year a larger number of towns have taken hold of the work, and there has been an increased membership where work had been done previously. A list of more than 1,600 local leaders, many of them giving gratuitous service. shows how firmly the club idea has taken root. This interest is not merely sectional. There is scarcely a town left in the State which has not been doing something during the past year. A small quantity of seed was sent to more than 20,000 boys and girls. As many more supplied themselves with seed from other sources. The club work makes a universal appeal, and children from all grades of society have been enrolled.

Work involved.

The field work, as indicated above, is in charge of Professor O. A. Morton, assisted by Miss Ethel H. Nash. The special work of Miss Nash is in the line of home economics, and will be treated in some detail later. In the performance of his duty, Mr. Morton has had occasion to confer with State officials, school and other town and city officials, officers of granges, of men's clubs and of other voluntary associations in nearly all parts of the State. Public addresses to the number of 250 have been delivered before the above-named organizations. In these addresses and conferences he has been in communication with more than 18,000 people. His work has also been identified with the extension schools of the college, as well as with the institute work of the State Board of Agriculture. Some part of his energy has been spent in assisting in the work of the agricultural and horticultural societies in their annual exhibits, and in the annual meeting and exhibit of the State Board of Agriculture. This, of course, involved much travel, and required an absence of several days each week, sometimes as many as five or six. Along with this he had to take care of a large correspondence, direct the sending of bulletins, — numbering thousands, — and attend to the distribution of seed to the 23,566 applicants.

Life in the field for Miss Nash was hardly, if any, less strenuous. Her work differed not at all in kind from that of Professor Morton so far as conferences, addresses, teaching and travel were concerned. It was restricted somewhat in scope, being devoted to home economics. It involved the sending of many circular letters and bulletins, and a large personal correspondence.

Contests and Awards.

The Home Economics Club.

This is one of the new enterprises inaugurated during the past year under the immediate direction of Miss Nash. The interest in this work was strong from the very beginning. More than 800 boys and girls entered the contest, and many of them carried it through to a triumphant finish. The work comprised 12 activities in cookery, 14 in household management and 8 in constructive handwork. The following list, score card, and rules exemplify the plan in some detail: —

Time Schedule.

Cookery: —	Hours.
Soup making,	20
Making and baking yeast bread,	40
Vegetables,	20
Cooking of meats,	20
Preparation of light dessert,	20
Making and baking pies,	20
Making and baking cake,	20
Making and baking cookies,	15
Making and frying doughnuts,	15
Preparing breakfast,	25
Cereal course, ¼.	
Main course, ½.	
Beverage course, ¼.	
Preparing supper,	25
Main course, ½.	
Dessert course, ½.	
Canning and preserving,	40

	Hours.
Household management: —	
Table setting,	5
Table serving,	5
Washing dishes,	10
Drying dishes and arranging in cupboard,	10
Sweeping and dusting,	20
Care of one's room,	20
Washing windows,	15
Cleaning floor,	10
Cleaning and filling lamps,	15
Building fire,	10
Blacking stove,	10
Assisting with washing,	15
Ironing,	20
Assisting in care of children,	15
Handwork: —	
Sewing, darning or mending,	20
Basket work, caning, crocheting, knitting or weaving,	20
Total,	500

Score Card.

Quality of work as shown by exhibits,	30
Skill shown in bread making or canning,	20
Quality of work as shown by inspection,	20
Quality of work as shown by reports,	20
Story of experience,	10
	100

Rules and Regulations.

1. The contestant must be between ten and eighteen years of age at the date of the beginning of the contest.

2. Each contestant must agree to do all the work without any outside help. All the work must be done by the member. Mothers or friends may advise and supervise, but *must not do any of the work.*

3. Each contestant must check a total of one hundred and fifty hours of work selected from the five hundred given above. At least seventy-five hours of work must be selected from the cookery.

4. Each local club must designate by vote either bread making, forty hours, or canning, forty hours, as a common activity which all the members must participate in. Either the bread making or the canning, whichever is selected, will receive special direction by the State adviser, and will be judged at a club meeting. The other activities will be

Richard W. Arms, Hopkinton. Champion in Market Garden Club, 1914.

Dorothy Rice, Westborough. Champion in Home Economics, 1914.

judged from reports, written story and visits to the homes of the members.

5. Each activity checked must be given during the contest period the exact number of hours listed; *i.e.,* if cooking meats is one of the activities checked, the contestant must devote at least twenty hours during the six months to this work. The contestant must so arrange the program that the one hundred and fifty hours will be distributed over at least three months of time.

6. Each contestant must follow very carefully recipes, suggestions and literature sent.

7. Each contestant must keep a daily time card. This card must be signed by the parent or guardian and submitted each week to the teacher or leader. At the end of four weeks the card must be sent for inspection to Professor Laura Comstock, Extension Professor of Home Economics, Massachusetts Agricultural College, Amherst, Massachusetts. These cards will be kept on file and used at the time of making awards.

8. All data asked for in the blank form must be kept by the contestant and included in the final report.

9. All members of the local or county clubs must attend meetings called by the leaders unless there is a good excuse for absence. No meeting will be called that requires long-time absences from home or much expense.

10. Each member will be required to bake at least 25 loaves of bread, if bread making is selected as the common club activity. For each lot of yeast bread made a record card must be kept and brought to the meeting at the time of the bread-baking contest, which will be at the close of the season. If canning is selected, at least 50 cans must be put up. These must be exhibited at the club meeting when the final canning contest is held.

11. The time of the contest will be from April 30 to October 31.

12. All entries must be made prior to April 30.

The prize for the champion in this club was a free trip to Washington, District of Columbia. It was won by Miss Dorothy Rice of Westborough, Massachusetts. Two second prizes were offered consisting of a trip to places of interest in New England. These were captured by Miss Florence Morton of Fairhaven and Andrew Rice of Wilbraham. Several third prizes were available which consist of a week's outing at the Massachusetts Agricultural College. These were awarded for meritorious work to all those whose average score did not fall below 90 per cent. The following persons were entitled to this prize: Mary Atkins, Harwich; Dorothy Miles, Holden;

Hermine Schulz, Roslindale; Mabelle Cady, Windsor; Rozella Ice, Williamsburg; Ethel Spooner, Brimfield; Frederick Rice, Wilbraham; Ruth Loud, North Abington; Helen Miller, Hadley; Helen Rowe, Bolton; and Rose Whiting, Lanesborough. All prize winners received a Diploma of Merit signed by the president of the college and the secretary of the State Board of Education.

Many of the written stories sent in by the contestants were quite artistic. They showed much care and a good degree of skill in their preparation. Some were illustrated with original drawings and others with photographs.

The ages of those engaged in this home economics work ranged from ten to seventeen years. There were 87 towns represented. One hundred and sixty-three teachers co-operated in the enterprise. The total number of loaves of bread was 4,454. The largest number of loaves made by one individual was 265. One girl alone put up 237 quarts of fruits and vegetables.

The Poultry Club.

This is another popular and valuable feature added during the past year. The work of the club was devoted to egg production exclusively. The contest lasted six months beginning in February, 1914. A twenty-five page bulletin, written by Professor J. C. Graham and published by the Extension Service, was sent to all members. It described in detail poultry-house construction, feeds and feeding, poultry hygiene, management and data for final report.

Egg-laying Contest.

Class 1, 6 hens or pullets.
Class 2, 12 hens or pullets.
Class 3, 25 hens or pullets.
Class 4, 50 hens or pullets.

Score Card.

Egg production,	40
Profits,	30
Reports,	15
Story,	15
	100

Rules and Regulations.

1. Members of this club shall be between the ages of ten and eighteen.

2. The period of competition shall be from February 1 to August 1.

3. There are four classes open for competition, — 1, 2, 3, 4, — and the number of hens or pullets entered in each class must be 6, 12, 25, 50, respectively.

4. The contesting fowls must be leg-banded (leg bands to be furnished by the college).

5. Members competing must own the fowls under their management.

6. The fowls may be of the club members' own raising, or may be obtained through a purchase or gift.

7. Standard-bred stock of one variety is recommended, but not required. Any variety or combination of varieties — pullets or hens — may be entered.

8. Layers must have from 5 to 8 square feet of floor space per bird.

9. Data must be kept according to record card and report blanks furnished.

10. Records every four weeks and final reports must be sent in promptly.

Nearly 100 contestants carried their enterprise to completion. The prizes were the same as for home economics. The winners in the egg-production contest were as follows: first prize, Raymond D. Blethen, Haverhill; second prize, Arthur O. Seher, Westfield; third prize, Dorothy Page, Hudson; Richard F. Devine, Foxborough; George E. Parker, Lynn; F. Cushing Foss, Norwood; Earl Augustus Garde, Lynn; Lucian W. Brown, Jr., Natick; Clarence E. Goodnow, Millington; Kenfred A. Root, Easthampton; Murray S. Graves, Williamsburg; and Louis E. Pelletier, Norwood; fourth prize, Clara H. Van Lennep, Great Barrington; H. Raymond Baker, Amherst; Chester S. Woodard, Leverett; Harold E. Thomson, North Dartmouth; Dwight H. Eaton, South Hadley Falls; Richard C. Peck, Bardwells Ferry; Andrew Carl Rice, Wilbraham; Meyer Koran, East Saugus; Ida L. Eddy, North Wilbraham; and Francis McElligott, Westfield.

There were some notable results obtained by the members of this club during the six months' contest. Raymond D. Blethen of Haverhill, winner of first prize, with 12 birds, got 101 eggs per hen. The enterprise gave him a net profit of $22.52. Arthur O. Seher of Westfield, with the same number of hens, secured 122 eggs per hen on which he made a profit of $15.99. Dorothy Page of Hudson with 12 hens secured 107 eggs per hen, making a profit of $19.45. Other members who obtained over 100 eggs per hen were Rexford A. Bristol, Foxborough; Cecil Leath, Milford; Louis E. Pelletier, Norwood; Meyer Koran, East Saugus; F. Cushing Foss, Norwood; Clarence E. Goodnow, Millington; Ida L. Eddy, North Wilbraham; Harold S. Cobb, Bernardston; Ernest A. Peterson, Saugus; Paul G. Kallstrom, Millbury; H. Raymond Baker, Amherst; Kenfred A. Root, Easthampton; Lucian W. Brown, Jr., Natick; and Richard F. Devine, Foxborough. The highest number of eggs obtained per hen was 122. This record was made by Arthur O. Seher and Richard F. Devine.

On account of the large number who completed their work in such a satisfactory manner, it was thought advisable that a rather liberal allowance of premiums should be awarded. The final rank was determined by the score card. A grade of 76 per cent was taken as a minimum. All contestants who did not fall below that figure were awarded either a first, a second, a third or a fourth premium. The highest score obtained was 91.3 per cent.

It is to be noted in this connection that neither the highest yield nor the greatest profit is wholly conclusive as to who wins. The business record and an intelligent write-up of the whole project are important factors which influence the final result. In fact, a good business statement and a well-written description may turn the scale in favor of one who would lose on the basis of production alone. The purpose is to make the enterprise as many sided as possible.

The Hay Club.

This was introduced on trial. It proved to be less popular and much more difficult to handle. Hay making is a job of man size. However, three courageous young spirits entered the contest, — Edward F. Parsons, North Amherst; Wilson Walker, Marlborough; and Elliott Taylor, Shelburne.

Wilson Walker used a meadow that was already seeded. The other two boys seeded down new tracts. High-class work was

John Devine, Hadley Champion in Corn Club, 1914.

Elliott Taylor, Shelburne Falls. Champion in Hay Growing, 1914

done in every case, and some excellent results were secured as shown by the reports which follow.

Edward F. Parsons of North Amherst raised 3,990 pounds of hay and rowen on one acre as a first crop after corn. Wilson Walker of Marlborough, on one and one-twelfth acres cut 6,202 pounds of hay from a six-year-old meadow. The rowen was pastured. Elliott Taylor of Shelburne raised 9,815 pounds of hay and rowen on an acre newly seeded on old turf land.

Market Garden Club.

The Market Garden Club bids fair to become the money producer. It permits both diversified and specialized production. It also allows for succession of crops during the growing season. This factor alone gives the market gardener a strong advantage over the grower of an all-season crop. Many of the short-term crops are also small in foliage. This makes interplanting possible, thus enabling the gardener to use nearly the entire surface of the land. The exceedingly close planting possible with such vegetables as chard and celery puts the market garden in a class by itself as a money maker. This is especially true where a good local market is available which permits of the sale and delivery of the vegetables fresh from the garden. This point is well illustrated in the case of Richard W. Arms of Hopkinton who won first prize in market gardening. This young man set a plot of 8 square rods to celery on July 3, 5 and 7, on which he used $2.65 worth of manure and fertilizer. He set 2,200 plants. The cost of tillage and hired labor amounted to $1.15 up to October 12. He began selling September 24, and by the end of October his account showed a net profit of $85.75 from one-twentieth of an acre. While this is exceptional, it shows what the possibilities are under favorable conditions. It also illustrates the desirability of getting green vegetables direct to the consumer in order to realize the best results.

Canning Club.

A small amount of experimental work was begun in this line with a few of the boys and girls in Amherst. A group of 16 was provided with a small tract on the college campus. Each member of the group bought 100 tomato plants. They were given careful instruction in setting, fertilizing and cultivating the same. As the fruit began to ripen the owners gathered it both for home use and for market. When the season was well on some co-operative canning was done. The group canned about 300 cans of tomatoes in tin. This work was done under the direction of the Department of Agricultural Education. It is inadvisable as yet to make any recommendations in regard to this type of work. These young people are not yet strongly imbued with the idea of co-operation.

Besides this simple experiment a large amount of splendid work was done in nearly all parts of the State in giving canning demonstrations. This demonstration work was carried on by both Professor Morton and Miss Nash. The method which has been emphasized is known as the "cold pack." The essential factor in this method consists in preparing the fruit or vegetables and placing them in the cans or jars cold, then sealing and sterilizing. In the case of glass jars, the sealing is only partially done before the sterilizing. The permanent sealing or tightening of the covers is done after sterilizing. Sterilization is secured by heating either in boiling water or under a low steam pressure. The superiority of the method and the great value of the art of canning as a means of taking care of surplus garden products warrant the promotion of this activity to the fullest extent. The demonstrations of the past year have laid the foundation for more systematic and more thorough work during the coming year.

Canning demonstrations were given to the number of 48. These were given before audiences aggregating nearly 4,000 persons. Mrs. George S. Ladd, lecturer of the State grange, has been deeply interested in the enterprise, and is aiding materially in its promotion by her influence among the subordinate granges. Without anticipating too much as to the work of the coming year, it may be stated here that as soon as the three months' contest in home economics, just initiated, is closed Miss Nash expects to devote her entire energy to the promotion of the canning project in all its aspects.

Corn Club.

This has been in operation for the past three years. It is not an easy enterprise to manage owing to the great variety of soil and climatic factors involved. Some sections seem well adapted to corn, others do not. Some soils are favorable while others in the same locality are not. The necessity for increasing the home-grown supply of grain seems to justify the continued promotion of this work.

About 75 boys engaged in corn growing the past year, the areas ranging from one-half to one acre. Fifteen of this number completed the work and made final reports. This, however, is not a fair measure of the success of the work. The season was late in the spring, and was shortened by an early frost in some sections which discouraged many members from reporting.

The prize winners in the corn-raising contest were as follows: first prize, John E. Devine, Amherst; second prize, Bernard Hartnett, North Hadley; third prize, Ferdinand J. Ice, Williamsburg; Donald Lent, Maynard; and Luman Barber, Bernardston.

The following are some of the facts that appear from a summary of the reports. The average yield per acre of the 15 reporting was 71 bushels. This is nearly twice the average for the State. The highest yield was 118 bushels field measure. Three competitors reported a yield of over 100 bushels, as follows: John E. Devine, Amherst; Ferdinand J. Ice, Williamsburg; and Russell G. Skinner, Brimfield.

The average profit per acre was $25.60. The highest profit was made by Luman Barber of Bernardston, amounting to $49.32. Three report having planted dent corn. The remainder report some variety of flint. The two highest yields were made by flint corn. White dent came in for third place, with 105 bushels. However, it lost 22.13 per cent when freed from water, while the flints that were tested lost 16 to 18 per cent.

The score card for corn was based on the following four items: yield, 30 per cent; profit, 30 per cent; ten-ear exhibit, 20 per cent; and written story, 20 per cent.

Potato Club.

Work in this group shows a good degree of interest. The areas planted ranged from a minimum of one-eighth of an acre to two acres. Seventy-six contestants made final reports. Green Mountain was the prevailing variety used, with a slight sprinkling of Cobbler, Delaware, Snow Flake, Norcross, Snow, Maine Snowball, Todd's Wonder and Mortgage Lifters. The yields have all been reduced to the acre basis for the purpose of easy comparison. Some noteworthy facts are shown in a summary of the reports. The highest yield was secured by Lawrence Estes of Windsor, amounting to 440 bushels per acre. He did this at a profit of $313.20. His sample scored 80. His rating by the score card was 95.5, winning the first prize which was a free trip to Washington. Other prize winners were: second prize, Harold A. Cady, Windsor; Isadore Horin, Westminster; and third prize, Harold L. Turner, North Reading; Curtis U. Metcalf, Saugus Center; Robert R. Luce, Plainfield; Edward O'Donnell, Oakham; Warren Hapgood, Saxonville; George A. Munson, Bisbees; Vincent Dunn, Marlborough; Harold Fairfield, Richmond; Arthur Harriss, Abington; Arnold Hale, Lee; Walter W. Stevens, Newburyport; Howard Estes, Windsor; Allen G. Truran, Pittsfield; Peter E. Szymkiewicz, Brockton; Ralph Estes, Windsor; Spenser H. Merriam, Westminster; Donald E. Sanderson, Haydenville, and William C. Pierce, Jr., Lincoln.

Some additional facts in regard to yields and profits may be noted. The average yield of the 21 members to whom prizes were awarded was 351.7 bushels per acre. Their average profit was $177.20. The highest yield was 440 bushels obtained by Lawrence Estes. The peck sample receiving the highest score, 92, was grown by Charles C. Wilson of Warren.

CITY, TOWN AND SCHOOL CONTESTS.

Some effort has been made during the year to enlist a more active co-operation in the club work on the part of municipalities. The effort has met with success. Several towns and some cities are awakening to the educational and economic advantages of the garden work, and are coming to its support with

Lawrence Estes (at the right), Windsor. Champion in Potato Growing, 1914

Sumner Metcalf, Saugus. A junior potato grower and the product of four tubers.

grants of money for paid supervision during the summer season. This is the crucial point in the entire enterprise. If the public refuses to incorporate the summer work and study of the children into its scheme of public education, the club work will be retarded but cannot fail. The propaganda must go on, evidence of its worth must be piled mountain high, demonstration added to demonstration, proof to proof, repetition upon repetition, until a somewhat patient tolerance becomes an aggressive conviction that in the garden education finds its most instructive book stimulant, and the morals of ownership their best means of development. After that it will seem even more rational to pay for the teaching of children in the summer out of doors than it now appears natural to throw them on their own resources during the best learning season of the year.

Brockton.

Some noteworthy cases of public interest are worth mentioning. The city of Brockton is rapidly becoming noted for the work it has been doing. The report of the supervisor, Annie L. Burke, shows that over 2,500 individual plots have been cultivated during the past summer; that 90 of these comprised one-twentieth of an acre or more; that the supervisor was assisted by 8 inspectors, each inspector being in charge of a separate district; that valuable prizes were won at various exhibitions; that garden crops of large value to the individuals were gathered; that the local exhibit in the city was visited by thousands of her citizens; that, best of all, among the moral results were the salvation of a twelve-year-old lad who had become so unruly at school and so incorrigible at home that his father was about to have him sent to a corrective institution. He became interested in a garden. His energy shifted from destructive to productive lines. He won $11.50 in a competitive exhibit. He found himself, and the real boy has been found by his friends. It is much easier to imagine than to measure the economic, intellectual and moral values that pass over from the adult to the rising generation when the neighbors and parents join hands with the children in such praiseworthy work. The joy of achievement in this sort of labor makes it play.

Hadley.

In sharp contrast from the city conditions of Brockton is the rural town of Hadley. Here are no factories of an imposing type, no congested centers where people live in flats or apartments, no narrow streets crowded with commercial traffic. Most of the people are farmers. Many of them live on their farms in the open country. It is adapted to a type of agriculture that makes it one of the wealthy towns in the matter of production. The chief crops are tobacco and onions. Hay, corn and potatoes find a fairly good place. A few years ago it produced large quantities of milk. Market gardening is becoming an important factor. The high value of the land for the production of tobacco, onions and market-garden products often stands in the way of the children's being allowed to have a flower bed or even a small vegetable garden. Many an eager child has to supplement with tears his petition to his father for enough ground to plant a little garden of his own.

Hadley is like Brockton in one respect. It is a splendid illustration of what may be accomplished in the summer education of its children by paid supervision. The work is in charge of E. J. Burke, the teacher of agriculture in the Hadley high school. Under the terms of his contract the summer months are devoted to the instruction and supervision of his high school pupils in their home projects. His weekly rounds among these young people bring him in touch with the children of the grammar grades who have gardens.

A perusal of the report of the work reveals the following facts: —

> The spring and early summer were trying times indeed for the young gardeners. With heavy wind storms, rain and weeks of cloudy weather, vegetation was retarded in its growth, and in many cases prevented germination entirely. The conditions were hard on the youngsters, but they never lost faith in their work, and continued to put into play many of the suggestions given by Professor Morton and myself. With the poor growing weather of the early summer crops did not look very encouraging, but finally in August a fine hot spell following a rain brought everything along in fine style, and the smiles grew more frequent when the gardeners saw that their work was not in vain, and

after all their hard luck they would have something to show at the school exhibit in the fall.

My work in supervising these club members is growing more difficult each year in many ways. In 1912 I had about 112 members; in 1913 about 263; while this year, 1914, I have 336 members. I am certain of a club of 500 within two years, and all this without any great amount of advertising for new members. They come in of their own volition, and up to date I have cared for each and every member (Russellville excepted) from seed time to harvest, and then again through exhibiting time. During the summer my visits per member will vary from two to four visits. Some I see six times, others but once. I keep an accurate record of every gardener and garden as to care and crops, and as to whether the boy or girl exhibits in the fall, and then again note the premiums won at regular agricultural fairs. I have a similar record of all club members in Hadley since my coming three years ago. These data tell many tales, and every time I glance through any part of them I learn something new about the work.

The Hadley exhibit, combined with the North Hadley exhibit, was held in the Hopkins Gymnasium on Friday, October 2. I was pleased with the showing, for it was easily the best attempt of the three years. It was interesting to compare the crops of the two sections of the town. The Hadley schools were excused at 2 P.M., and all came to see, for many of them, their first exhibit. Last year an epidemic broke out, and schools were closed on the afternoon of our exhibit, so all were sent home with sad hearts and accompanying tears. This year they all made up for lost time by coming in the afternoon and bringing their parents in the evening.

The townspeople turned out in large numbers at both exhibits. I know their eyes were opened in many cases. They never grew better corn or potatoes than they saw at these shows. The farmers admitted this point.

Hadley exhibited at the Amherst and again at the Northampton Fair. At Amherst, through the generosity of Professor Hart, we had enough room to display about three-quarters of our total products, while at Northampton we had room for but one-half of our exhibit, the other half going under the display table. At this latter fair we experienced a stroke of hard luck. Through an error in the secretary's office our entry blanks were lost and our goods were practically excluded from competition and premiums as well. The judges felt badly over this point. Our exhibits would have won the premiums in many cases had it not been for this mistake. Mr. Clapp of the Smith School was a judge, and his letter to me which I am forwarding with the other material will let you see how we lost out, or rather why we did not receive more premiums at the Northampton Fair. I hope that blow will not distance us entirely. The youngsters won about $35 at Amherst, which is double their winnings of one year ago.

Personally, I wish I had more time to devote to this work. Could I afford to spend one-half of my time with these boys and girls great results would be obtained. The land is here, the workers are here, and the fine inspiration from the Massachusetts Agricultural College is here, so good results should be forthcoming and I know they are.

Arlington.

Several other localities did good work in the city and town contests. Mrs. W. F. Eastwood had charge of the gardens in Arlington. The following extracts appear in the report of her work: —

As supervisor of the garden work for the Home and School Garden Association of Arlington, I wish to say that 800 home gardens and 1 school garden came under my care and supervision. Eleven adult volunteers assisted in home visiting and in various other ways. Some of the older pupils were also quite helpful in reporting on home gardening from time to time.

Gardening to many of the children was a new thing. Many had moved from the city or had never given the subject much thought. To others it was an old humdrum story. All their lives they had seen it going on about them. There was no special message in the soil for them. They had never observed Mother Nature and her wonderful ways. There was no value they could especially share in, and no science they could appreciate. It was hard work, that was all, and work mostly for men. Of course, here and there were some who had a natural liking for it. In one section of Arlington, the Crosby district, children's home garden work had been successfully carried on by a volunteer worker, Miss Esther Wyman, for two years. A school garden was started in the spring, but not kept up through the summer, as Miss Wyman was usually absent through the vacation months. Prizes had been awarded the children and a keen interest aroused. Thus the Crosby school children were in the lead. To stimulate a desire on the part of the children all over the town to catch up with these more fortunate ones, and arouse a vital interest in the subject on the part of all, was my first desire. How was it to be done? When I thought of Amherst the way seemed clear. I would tell the children about the Bureau of Plant Industry with its far-reaching system planned entirely for boys and girls, and reaching all over the State. I would tell them about the awards of buttons, ribbons, medals and diplomas, and of the trips to Washington and nearer places for those continuing faithfully from year to year. I would tell them of the seeds, and tubers for potatoes, to be planted. I would also tell them of the records kept, and of the primers and pamphlets to be obtained on gardening, and all kindred subjects; also that hundreds of other boys and girls throughout the State were enrolled, and all aiming to do good work.

A new opportunity seemed to be opened to them, and a dignity and value seemed bestowed on that kind of work; moreover, a gift of seeds from the Agricultural College would involve a responsibility on their part.

Seeds were furnished the children through the Boston Social Union Seed Distribution. In one school alone 500 orders were given. The average order was 10 cents, though they ranged from 3 to 30 cents. Cards for the home visiting were filled out and returned to me. Each garden, as a rule, was visited three times during the summer; occasionally, a fourth visit was paid. Every Wednesday afternoon until the middle of September a garden conference was held at the public library in the boys' debating room. The volunteers met at this time and talked over the gardens. Children came regularly to report on their gardens and whatever difficulties they were trying to overcome. A kind of exchange and co-operative station was set up on a small scale. Seedlings and plants were distributed. The owners of two or three large gardens were very generous in keeping us supplied from time to time. One or two boys also took orders for some of their produce from their gardens.

At the Massachusetts Horticultural Exhibition in Boston, 3 first, 2 second, 1 third, 1 fifth and 12 special prizes, a total of 19, were awarded, amounting to $23.75.

Of the 800 gardens started, most of them were successfully kept up to the end, except where the children were away for the summer. At the Arlington exhibition, which was held in a large hall in the high school, the entire town was surprised by the size and quality of the flowers and vegetables raised by the children. Six prizes, three for flowers and three for vegetables, were awarded to all the grades from the fifth in the grammar school to the first in the high school. Also some specials were awarded. These were carried off by well-deserving gardeners. The Amherst gold medals, 8 in all, were the crowning glory. The ribbons and buttons were received with great appreciation and played a most valuable part, being highly appreciated and esteemed by all. Those prizes were decided by expert market gardeners who acted as judges for the vegetables, and those equally well qualified judged the flowers.

One boy who had taken special pains with his garden asked his mother how many feet he had traveled toward Washington. The mother, failing to appreciate the boy's efforts, told him he would be lucky if his face ever got turned that way. This same mother, on the morning of the exhibition, loaded the baby carriage with vegetables and laboriously pushed it more than a mile to the center of the town. The interested little gardener followed along with a squash weighing 14 pounds. As he neared the school district he told his mother he thought he would go ahead. "And John," she said, "never moved so swiftly in his life. It was plain to see that the boy, as well as myself, thought we looked like immigrants. I left all the produce on the steps of the high school," she said, "and milord carried it all to the hall above. John never worked so hard in his life; he was so afraid the other boys would get ahead of him."

One mother said: "The gardening is doing us two good turns. First, there is a saving of doctor's bills, and second, it is making farmers of our boys, to say nothing of the vegetables we get for the family. I have never been so well in my life, for I have become so interested in what the children are doing that I stay out of doors, and we are all interested in something worth while. That's the secret."

It goes without saying that Arlington is a splendid field for garden work. But children need constant supervision and encouragement, and were one able to give more time than I was permitted to give, they would soon stand well up on the scale among those who attempt gardening.

Waltham.

The work at Waltham was in charge of Miss Louise Fay as general supervisor. The conditions resemble rather closely those at Brockton. Some extracts from Miss Fay's report will indicate the scope and character of the enterprise.

The aim of the Waltham Home Garden Association is twofold, — the benefit of garden work to the child in his development, and the improvement of home and public grounds throughout the city.

Large areas for cultivation are not available in Waltham. The children are encouraged to utilize to the best advantage the ground around their homes by planting trees, shrubs, vines and flowers to beautify their surroundings, and, where space will allow, by the cultivation of a vegetable garden.

The director's work began with talks in the schools, illustrated by lantern slides, showing children's flower and vegetable gardens. As class exercises, the pupils planted seeds in flats furnished by the manual-training department. The seedlings were taken home and transplanted in the children's home gardens. Plans of vegetable gardens were drawn.

The city appropriated money for the improvement of three of the school yards, and extensive planting of trees and shrubbery was done by the pupils under the supervision of the city engineer. There is excellent co-operation on the part of the city officials, school authorities, and individual members of the Home Garden Association. The director was assisted by 15 inspectors who visited the children's gardens.

The class of children most interested in Waltham are those who seem to have the hardest conditions to overcome. What is considered achievement on their part would not be for some who have better opportunities.

Previous to the exhibition lessons were given showing the children the proper selection of vegetables and artistic arrangement of flowers. A marked improvement in the arrangement of exhibits was noted.

The regular inspection of the gardens does more, perhaps, than anything else to stimulate the interest of the children. In addition to the calls made by the volunteer visitors about 800 calls were made by the director.

The children were very faithful in attendance at the school gardens twice a week, and all kept their individual plots in excellent condition.

All associated with the work report a greatly increased interest on the part of the children to put forth better efforts another year.

Milton.

Miss Mabel E. Turner is in charge as garden supervisor. There were 966 children in Milton between the ages of seven and fourteen. Two hundred and thirty-six of these had small home gardens. Sixty-nine cultivated plots from 1 to 6 square rods. Four planted one-twentieth of an acre each in tomatoes. Twenty-one first prizes were won at the regular agricultural fair, besides 19 second prizes and 9 third prizes. The following persons are in active co-operation with the work: Philip Chase, Nathaniel T. Kidder, Mrs. Allerton James and Miss Julia Gordon.

Groton.

The gardens in Groton have been in charge of Miss Elizabeth S. Hill for several years past. The efficiency of the supervision is indicated by the fact that 69 per cent. of the children between seven and fourteen had gardens during the past season. The school committee, the Village Improvement Society and the Woman's Club co-operate in financing the project. The following extracts are taken from Miss Hill's report: —

> The money won last year by Groton from Amherst was used to pay the salary of a nature teacher in the schools. Twenty-five lessons were given in the various schools. A nature course was laid out, including agriculture and gardening for all grades under the high school. The

teachers and scholars were very enthusiastic and interested. Care of cattle, horses, farm buildings, gardening, insects, birds, animals, trees, flowers, etc., were studied and home records kept. "Out of Doors Books" and weather charts were very popular, one of which I am sending as a sample. This was so well received by the schools, and the committee was so well pleased with the results, that the town voted to appropriate $350 for the school gardens and nature study for the schools. This gives the supervisor a strenuous, poorly paid year, with no vacation whatever since December. Other special teachers are paid the same amount for salary *alone,* thirty-eight weeks' schooling, with eight rooms, once a month in each room. The nature teacher reaches every room in town, with one exception, every week, then gardens the rest of the year. This year we have planned for a vacation in the winter months.

We had 5 school gardens and over 200 home gardens. For the year they averaged the best since the starting of school gardens. A pine nursery was planted at the Moors School, W. P. Wharton giving instructions as well as seeds. It is cared for by the children. About 100 little pines are growing under a frame made by one of the boys.

The school garden at Groton was well kept and handsome. Twenty children attended well all summer. Miss Gladys Mason and Miss Elizabeth Blood assisted in this garden. Their reports have not been received as yet.

The West Groton school garden was very successful. The location was much better than last year.

The scout garden at West Groton was very prolific and handsome. This was planted the last of June, and the first frost came the first of September. The vegetables matured and grew very rapidly, — radishes in eleven days. Of the pumpkins and squashes many weighed over 50 pounds apiece; the other things were in proportion. Cauliflower is still heading, — 100 good plants; lettuce is still fine; 2,000 cabbage headed well. Over $100 worth was raised this summer in three months on this one-quarter of an acre by 60 school garden workers.

The school gardens won first prize in flowers and third in vegetables at Horticultural Hall in Boston. The scout gardens won first at the Clinton Fair; the Groton and West Groton gardens, second at Clinton; the scout gardens, second on squash at Clinton. The children's exhibit at the Groton Fair was the best ever held. They were arranged on tables outside the hall. Money prizes, gold pins, buttons and ribbons were given at that time. The judges were William P. Wharton, Miss Susan P. Hill and Miss Bertha Bixby.

The best growth of potatoes from the four sent by Amherst was made in the scout gardens by Harvey Laurence. Many of the home gardens were reported to me. The produce thus reported has a total valuation of over $350. This does not include the larger areas.

FINANCIAL STATEMENT, NOV. 30, 1914.

Appropriation (through Board of Agriculture),		$2,000 00
Cash prizes,	$930 00	
Cups, badges, buttons and ribbons,	510 98	
Travel,	44 76	
Printing,	369 61	
		1,855 35
Returned to treasury,		$144 65

Respectfully submitted,

WILLIAM R. HART,
Specialist in charge of Agricultural Club Work.

ELEVENTH ANNUAL REPORT

OF THE

STATE FORESTER.

FIRE OBSERVATION TOWER, HANSON, MASS.

The forest fire observation tower at Hanson. This tower was constructed through the co-operation of the surrounding towns with the State Forester.

ELEVENTH ANNUAL REPORT OF THE STATE FORESTER.

Introduction.

The granting by the General Court at its last session of an appropriation of $90,000 for the purchase of State forests, the enactment of both the forest taxation law and regulations for the disposal of slash bordering forestry operations, together with an increased forest fire appropriation, were in themselves sufficient to give encouragement to any State forester.

The season of 1914 to our mind eclipsed all previous ones in undertakings and accomplishments. It is therefore with a great deal of pride and no little pleasure that your State Forester presents this, his annual report, outlining in a general way the activities of this department for the past year. He fully realizes that for whatever progress has been made the credit belongs to no one person, but to the splendid co-operation on the part of the people generally.

"Conservation" has come to be the term that stands for accomplishing something in the economic utilization of our natural resources throughout the nation, and it is an ungrateful citizenship that will not respond to aiding this great and important cause. Our Massachusetts people have awakened to not only talk and advocate conservation, but have gone even farther and enlisted in a campaign of restoration and utilization as well as "conservation." Our State being one of the oldest, and abounding in excellent markets, the forest products have been heavily drawn upon, and hence our forest lands have been rapidly depleted. Now that other and further sources of supply have met with similar experience, the time has come when we must determine our future source of forest products. Upon turning to a study of forest culture and management we find here in Massachusetts a fertile field for great accomplishments.

During each successive year, of late, we have been the more able to do work that begins to show definite results. Our splendid forest fire protective system in Massachusetts is certainly something of which we may all be proud. Where forest fires a few years ago were allowed to run at will, to-day we aim to detect and extinguish them at once. Our system consists of 26 observation towers scattered over the State, each containing a wide-awake observer, who has telephone connection with forest wardens in each city and town, 353 in all. In addition we have 1,500 deputies, a State Fire Warden with his four assistants, who patrol each section of the State in auto runabouts, and also 300 rural mail carriers whose duty it is to report fires. With this comprehensive system it can be plainly seen that the danger of the destruction of forests by fire is rapidly being overcome.

Next from point of importance to forest fires comes, probably, forest taxation. The past season realized the placing of a rational and workable forest tax law on our statute books. By registering forest land in accordance with the new law any one may have a comprehensive and definite knowledge of what his future forest taxes will be. This law is automatic, and is a safety valve for rational forestry investment. It took six years to secure this forest taxation law, as it necessitated a change in the State Constitution and an acceptance by the people, even before a commission could be appointed to draft and submit the new law to the Legislature.

The new *slash law,* which takes effect Jan. 1, 1915, requires that all lumbermen, farmers or others who operate wood lots hereafter must remove or destroy all brush or slash for a distance of 40 feet from the highway, railroad or abutting woodland. This law will render conditions far more favorable for handling incipient forest fires. The strip will act as a natural forest fire line.

With the above regulations added to our numerous previous acts, such as the permit act, the forest warden act, the reforestation act, the forest domain act, the town forest fire equipment act, etc., we now have a set of fundamental laws which we may proudly acclaim in their entirety, and which make up what the State Forester chooses to designate as the Massachusetts forest policy. For a fuller discussion in detail the reader is referred to a paper entitled "The Massachusetts Forest Policy," which the State Forester read before the Society for the Promotion of Agricultural Science, at Washington, D. C., on Nov. 11, 1914, and which is reprinted elsewhere in this report.

It has taken eleven years since the creating of the office of State Forester, therefore, to arrive at our present well-rounded-out forestry system. It now behooves us to build up a splendid State forest structure upon this foundation. The energies of the State Forester henceforth will be to explain, simplify and put into practical operation forestry practices of all sorts, and he asks the whole-hearted co-operation of all Massachusetts citizens to that end.

While it has been necessary for the State Forester to go to the Legislature each year for many new laws and special appropriations, it is believed that our future forestry bills will be more spontaneous and come from our people themselves. We have at the present time not only cordial co-operation and interest on the part of the lawmakers themselves, but much interest is shown in the State, city and local organizations of every kind. Examples of these are the Patrons of Husbandry or State Grange; State Board of Agriculture; Federation of Women's Clubs; boards of trade; sportsmen's organizations, etc.

The one organization in particular which has, from its natural affiliations and close association with the State Forester, been of great assistance is the Massachusetts Forestry Association. This organization introduced the bill creating this office, and the development of forestry interest throughout Massachusetts can be gauged by the great increase in membership of this association alone. A few years ago a membership of 800 was pointed to with pride, while the past year its membership totaled 3,200. This organization is not only interested in modern forestry development, as, for example, in offering a prize for a competition in municipal forest planting of 50,000 young trees to the winner this next spring, but the association is also deeply interested in roadside trees and shade trees of all kinds. Last spring a great deal of interest was aroused in a competition by various cities and towns over roadside tree planting, and the winning town was given the trees and the expense of planting two miles of roadsides. It is needless to point out that this work popularizes forestry and educates our citizens, and particularly the coming generation, to appreciate trees and forestry.

Under the head of "Forest Management," which is treated more in detail in this report, the department has made 58 examinations which cover a total area of 13,255 acres. Working plans, making forest fire lines and mapping work have also come under this head.

The department has again increased its nursery work by establishing a new nursery at Barnstable, Mass., which will be used largely for growing seedlings. This nursery, in conjunction with our old one at Amherst, will supply us with sufficient stock to meet our increased demands. The new seed beds at the Barnstable nursery contain as fine a stand of seedlings as the writer has ever seen. A transplant nursery has been started on the grounds of the State Farm at Bridgewater, and it is our purpose to greatly enlarge this acreage in the spring. A large amount of nursery stock was given to various State institutions for planting upon their holdings the past year.

The practice of aiding towns and cities from the State appropriation, in getting better and more permanent equipment for use in work against the gypsy and the brown-tail moths, has been followed throughout the past season, with the result that they are in a position to do far more effective work in the future, and at less expense. Where this office is getting proper co-operation from cities and towns (and this is quite general) the moth work is constantly improving.

Now that the United States Department of Agriculture has for the past two years assumed the work of checking the spread of the gypsy moth, and also taken over the parasite work, our State work has become more specific and definite. Each year a number of towns and cities that have been having State aid are added to the list of those self-supporting. Such cities and towns, now that they have had assistance and are in a position to handle their work within their liability, should be compelled hereafter to keep it up to this standard of efficiency. The State appropriation for the coming year is needed in aiding those towns that in the past have had scattering infestations which now have become very general. As long as there are but a few insects little co-operation is forthcoming, but when the stripping stage is reached then people begin to realize the danger.

During the past year, at a request from the United States Department of Agriculture, a number of towns situated just within the so-called border towns now being handled by that department were scouted and given special consideration. As the government is faithfully attempting, at great expense, to check the spread into new territory, it was thought a wise expenditure of State funds to thus co-operate. During the coming year the central and north cape country will need a great deal of attention.

The forest-thinning method of handling the moths, whereby the trees preferred by them are removed, and resistant species retained, and even planted, has proved, with spraying, a great success. Many woodland owners are taking advantage of this practice, and we predict that as rapidly as markets can be worked up for the products removed this work will just as rapidly increase. This work has not only the advantage of permanency, but it brings about a more economic forestry condition for the future. The subject is discussed more fully elsewhere in this report.

Briefly, therefore, the moth suppression work is being handled with a definiteness of purpose, and that real gains are being made there is no doubt. The work should be continued along our present lines, taking advantage of every method or combination of methods that will get results economically.

This report itself contains much else in detail about forestry in general, and our moth work, and by this introduction it is hoped the reader may be interested to look more deeply into our various activities.

ORGANIZATION.

During the year there have been a few changes, but generally speaking the personnel of the staff has remained the same.

Mr. R. S. Langdell, who has been an assistant in charge of reforestation work for seven years, resigned last spring to engage in commercial forestry work. He has become one of the firm of the Franklin Forestry Company, and has charge of their reforestation work. Mr. Langdell was first employed to take charge of the nursery work, and to him is due the credit for the splendid success that we have had in growing seedlings and transplants for our State work. It was with reluctance that we accepted his resignation. Mr. Langdell's work has been for the time being placed under the supervision of Mr. H. O. Cook, while Mr. J. R. Simmons, a young man who was employed as a college forestry student from Syracuse University during the summer of 1912 on forest mapping, was hired to have charge of the nursery work.

Mr. Roy G. Pierce, M.F., who became a member of the staff as assistant in charge of chestnut blight work, in co-operation with the United States Department of Agriculture, and had been with us for over a year, finished his duties with us at the completion of the term of agreement, July 1, and returned to Washington, D. C. Mr. Pierce proved an enthusiastic worker, and did very much to acquaint our people with the chestnut disease and methods of handling it.

Mr. Ray Weston, M.F., was employed during the year to assist Mr. Kneeland in the forest thinning work for controlling moth suppression.

The remainder of the organization is practically the same as last year, with slight alterations.

The organization follows: —

GENERAL STAFF.

F. W. RANE, B.Agr., M.Sc.,	State Forester.
C. O. BAILEY,	Secretary.
ELIZABETH HUBBARD,	Bookkeeper.
JOSEPHA L. GALLAGHER,	Clerk.
ELIZABETH T. HARRAGHY,	Stenographer.
JENNIE D. KENYON,	Stenographer.
JAMES H. CROWLEY,	Office boy.

GENERAL FORESTRY.

F W. RANE, B. Agr., M.Sc.,	State Forester.
H. O. COOK, M.F.,	Assistant Forester.
F. L. HAYNES, B.F.,	Forest examiner.
J. R. SIMMONS, B.Sc.,	Reforestation work.
HAROLD FAY, M.F.,	Forest mapping.

Eben Smith,	Superintendent, Barnstable Nursery.
Dean Townsley,	Superintendent, Amherst Nursery.
J. L. Peabody,	Field foreman.
James Morris.	Field foreman.
H. N. Butler,	Field foreman.
H. G. Tavener,	Field foreman.
H. H. Chase,	Field foreman.

Staff, Moth Work.

F. W. Rane, B.Agr., M.Sc.	State Forester.
Geo. A. Smith,	Assistant (equipment, accounts, etc.).
Paul D. Kneeland, M.F.,	Assistant (woodlands, products, etc.).
John Murdoch, Jr., A.M.,	Assistant.
Ray F. Weston, M.F.,	Assistant.
Francis V. Learoyd,	Clerk.

District Moth Men.

1. John W. Enwright, Medford.
2. Saul Phillips, Beverly.
3. John J. Fitzgerald, Haverhill.
4. Wm. A. Hatch, Marlborough.
5. Harry B. Ramsey, Worcester.
6. C. W. Parkhurst, Medfield.
7. W. F. Holmes, East Braintree.
8. J. A. Farley, Plymouth.

Staff, Forest Fire Prevention.

F. W. Rane, B.Agr., M.Sc.,	State Forester.
M. C. Hutchins,	State Fire Warden.
Miner E. Fenn,	Assistant.
James E. Moloy,	Locomotive inspector.

District Forest Wardens.

1. Oscar L. Noyes, Byfield.
2. J. J. Shepherd, Pembroke.
3. John P. Crowe, Westborough.
4. Albert R. Ordway, Westfield.

Observers.

District 1.

Wm. Bray, Georgetown.
Geo. G. Calvert, Sharon.
J. Frank Hammond, Chelmsford.
Elliot C. Harrington, Milton.
Caplis McCormick, Essex.
John H. O'Donnell, Wakefield.

District 2.

Calvin Benson, Barnstable.
Walter H. Blake, Dighton.
Frank L. Buckingham, Plymouth.
Alvaro Harnden, Fall River.
S. Matthews, Middleborough.
Calvin C. Parker, North Harwich.
W. F. Raymond, Bournedale.
Cushing O. Thomas, South Hanson.
W. I. Moody, Falmouth.

District 3.

A. M. Bennett, Pelham.
John Giblin, Westborough.
J. H. Lombard, Warwick.
James Maley, Princeton.
Geo. W. Sherman, Brimfield.

District 4.

C. M. Brown, Ashfield.
H. H. Fitzroy, Savoy.
Chas. F. Kimball, Becket.
Geo. C. Miller, Easthampton.
Nelson C. Woodward, Shelburne.

LIST OF FOREST WARDENS AND LOCAL MOTH SUPERINTENDENTS.

[Alphabetically by towns and cities.]

TELEPHONE NUMBER.	Forest Warden.	Town or City.	Local Moth Superintendent.	Div. No.
57-W, Rockland,	Arthur B. Reed,	**Abington,**	C. F. Shaw,	7
10-4,	W. H. Kingsley,	**Acton,**	J. O'Neil,	4
2003-M,	Henry F. Taber,	**Acushnet,**	A. P. R. Gilmore,	8
2-0, Kippers,	John Claney,	**Adams,**	John Clancy,	5
1431-M,	E. M. Hitchcock,	**Agawam,**	– –	–
151-32, Great Barrington.	J. H. Wilcox, State Line,	**Alford,**	– –	–
274-M,	James E. Feltham,	**Amesbury,**	A. L. Stover,	3
174-Y,	A. F. Bardwell,	**Amherst,**	W. H. Smith,	5
212,	John H. Baker,	**Andover,**	J. H. Playdon,	3
35 or 206,	Walter H. Pierce,	**Arlington,**	Daniel M. Daley,	1
2-12,	J. T. Withington,	**Ashburnham,**	Chas. H. Pratt,	4
24-2,	Wm. S. Green,	**Ashby,**	Fred C. Allen,	4
4-12,	Chas. A. Hall,	**Ashfield,**	– – –	–
479-W,	Horace H. Piper,	**Ashland,**	Theodore P. Hall,	6
48-J or 72-4,	Frank P. Hall,	**Athol,**	W. S. Penniman,	5
34-4,	Hiram R. Packard,	**Attleborough,**	W. E. S. Smith,	6
5-17,	J. F. Searle,	**Auburn,**	J. F. Searle,	5
3259-M,	J. W. McCarty,	**Avon,**	W. W. Beals,	7
96-4 or 47-4,	Chas. E. Perrin,	**Ayer,**	D. C. Smith,	4
144-2,	Henry C. Bacon, Hyannis,	**Barnstable,**	F. W. Chase,	8
83-4,	A. E. Traver,	**Barre,**	G. R. Simonds,	5
18 or 8000,	P. B. McCormick,	**Becket,**	– –	
117-1 Lex.,	Chas. E. Williams,	**Bedford,**	W. A. Cutler,	1
10-2,	Jas. A. Peeso,	**Belchertown,**	E. C. Howard,	5
8157-22, Milford,	L. Francis Thayer,	**Bellingham,**	H. A. Whitney,	6
409-W,	John F. Leonard,	**Belmont,**	C. H. Houlahan,	1
1367-M,	G. H. Babbitt, Taunton, R. F. D.	**Berkley,**	A. A. Briggs,	6
14-6,	Walter Cole,	**Berlin,**	E. C. Ross,	4
2-13,	Edson W. Hale,	**Bernardston,**	Edwin B. Hale,	5
319-J,	Robert H. Grant,	**Beverly,**	J. B. Brown,	2
22-2,	E. N. Bartlett,	**Billerica,**	W. H. O'Brien,	1
875-L-1, Woonsocket.	Thomas Reilly,	**Blackstone,**	A. J. Gibbons,	5
12-2,	I. E. Whitney,	**Blandford,**	– –	–
9-14,	E. Eliot Hurlbut,	**Bolton,**	C. E. Mace,	4
– –	– –	**Boston,**	Park and Recreation Department.	1
103-13,	Emory A. Ellis, Bournedale.	**Bourne,**	Edward D. Nickerson.	8

LIST OF FOREST WARDENS AND LOCAL MOTH SUPERINTENDENTS — *Con.*

TELEPHONE NUMBER.	Forest Warden.	Town or City.	Local Moth Superintendent.	Div. No.
No telephone,	H. J. Livermore,	**Boxborough,**	C. E. Sherry,	4
42-21, Georgetown.	Harry L. Cole, Georgetown, R. F. D.	**Boxford,**	C. Perley,	3
4-4,	John N. Flagg,	**Boylston,**	R. B. Smith,	5
433-R,	Jas. M. Cutting, South Braintree.	**Braintree,**	Clarence R. Bestick.	7
No telephone,	T. B. Tubman,	**Brewster,**	Russell D. Eaton,	8
8-6,	Edwin S. Rhoades,	**Bridgewater,**	F. C. Worthen,	7
14-3,	Geo. E. Hitchcock,	**Brimfield,**	G. E. Hitchcock,	5
1041 or 2020,	Harry L. Marston,	**Brockton,**	Geo. C. Kane,	7
101-13,	Elbert L. Bemis,	**Brookfield,**	J. H. Conant,	5
376,	Geo. H. Johnson,	**Brookline,**	Ernest B. Dane,	1
52-8,	Gilbert E. Griswold,	**Buckland,**	– –	–
No telephone,	W. W. Skelton,	**Burlington,**	W. W. Skelton,	1
51-4,	Robert C. Hughes,	**Canton,**	A. Hemenway,	7
– –	– –	**Cambridge,**	J. F. Donnelly,	1
76-5, Concord,	Geo. G. Wilkins,	**Carlisle,**	G. G. Wilkins,	1
16-2,	Herbert F. Atwood,	**Carver,**	H. F. Atwood,	8
14-12,	Albert L. Veber,	**Charlemont,**	– –	–
32-22,	Chas. S. McKinstry,	**Charlton,**	J. D. Fellows,	5
28-3,	Geo. W. Ryder, West Chatham.	**Chatham,**	Mervyn R. Martin,	8
1597-R, Lowell,	Arnold C. Perham,	**Chelmsford,**	M. A. Bean,	1
– –	– –	**Chelsea,**	J. A. O'Brien,	1
167-3,	Chas. D. Cummings,	**Cheshire,**	– –	–
7-4,	Wm. E. Major,	**Chester,**	– –	–
4,	Chas. A. Bisbee, Bisbees,	**Chesterfield,**	– –	–
149-M or 149-W,	John E. Pomphret,	**Chicopee,**	Z. Pilland,	5
216-14,	Ernest C. Mayhew,	**Chilmark,**	A. S. Tilton,	8
No telephone,	Danforth Blanchard, North Adams, R. F. D.	**Clarksburg,**	Geo. Tisdale,	5
551-M,	Patrick H. Kelley,	**Clinton,**	John B. Connery,	4
177-3 or 260,	Wm. J. Brennock,	**Cohasset,**	Wm. H. McArthur,	7
13-9,	E. H. Temple, Shattuckville.	**Colrain,**	Edgar F. Copeland,	5
75-3,	Frank W. Holden,	**Concord,**	H. P. Richardson,	4
5-3,	Edgar Jones,	**Conway,**	– –	–
8001,	Thos. A. Gabb,	**Cummington,**	– –	–
42-12,	S. L. Caesar,	**Dalton,**	– –	–
No telephone,	Thos. L. Thayer, North Dana.	**Dana,**	T. L. Thayer,	5
295-W,	Michael H. Barry,	**Danvers,**	T. E. Tinsley,	2
14-3, Westport,	Ezekiel W. Reed, North Dartmouth.	**Dartmouth,**	E. M. Munson,	8

LIST OF FOREST WARDENS AND LOCAL MOTH SUPERINTENDENTS — *Con.*

Telephone Number.	Forest Warden.	Town or City.	Local Moth Superintendent.	Div. No.
35-R,	H. J. Harrigan,	**Dedham,**	J. T. Kennedy,	7
273-14, Greenfield,	Wm. L. Harris,	**Deerfield,**	Wm. L. Harris,	5
No telephone,	Chas. E. Pierce, South Dennis.	**Dennis,**	H. H. Sears,	8
29-3,	Ralph Earle,	**Dighton,**	D. F. Lane,	6
11-4,	Wm. L. Church,	**Douglas,**	F. J. Libby,	5
372-3,	John Breagy,	**Dover,**	H. L. MacKenzie,	6
3353-2,	Frank H. Gunther,	**Dracut,**	T. F. Carrick,	1
152-2, Webster,	F. A Putnam,	**Dudley,**	Frank W. Bateman.	5
5-11, Tyngsborough.	Archie W. Swallow,	**Dunstable,**	W. H. Savill,	4
4-2, Duxbury,	Henry A. Fish, South Duxbury.	**Duxbury,**	H. A. Fish,	7
146-5,	Richard H. Copeland, Box 115, Elmwood.	**E. Bridgewater,**	Frank H. Taylor,	7
8-5,	Asher Markham,	**E. Longmeadow,**	- -	-
24-3,	Adin L. Gill,	**Eastham,**	N. P. Clark,	8
2-11,	J. M. Dineen,	**Easthampton,**	- -	-
76,	Frederick Hanlon, North Easton.	**Easton,**	R. W. Melendy,	6
241-2,	Manuel S. Swartz,	**Edgartown,**	John P. Fuller,	8
165-25,	Frank W. Bradford, Great Barrington.	**Egremont,**	- -	-
17-11,	Herbert A. Coolbeth,	**Enfield,**	H. C. Moore,	5
No telephone,	Chas. H. Holmes, Farley.	**Erving,**	Chas. H. Holmes,	5
23-5,	Otis O. Story,	**Essex,**	O. O. Story,	2
- -	- -	**Everett,**	P. O. Sefton,	1
1686-Y,	Chas. F. Benson,	**Fairhaven,**	G. W. King,	8
822-W,	Wm. Stevenson,	**Fall River,**	Wm. Stevenson,	8
136-2,	H. H. Lawrence, Teaticket.	**Falmouth,**	W. B. Bosworth,	8
745,	P. S. Bunker,	**Fitchburg,**	Page S. Bunker,	4
Hoosac Tunnel pay station.	H. B. Brown, Drury,	**Florida,**	- -	-
15-5 or 76-3,	Ernest A. White,	**Foxborough,**	F. S. Richardson,	6
352-4, South Framingham.	B. P. Winch,	**Framingham,**	N. I. Bowditch,	6
66-12,	Edward S. Cook,	**Franklin,**	J. W. Stobbart,	6
3-12,	Andrew Hathaway, Assonet.	**Freetown,**	G. M. Nichols,	8
191-M,	Geo. S. Hodgman,	**Gardner,**	T. W. Danforth,	5
- -	Leander B. Smalley, Menemsha.	**Gay Head,**	J. W. Belain,	8
31-4,	Clinton J. Eaton,	**Georgetown,**	C. J. Eaton,	3
4-15, Bernardston,	Lewis C. Munn, Turners Falls.	**Gill,**	R. E. White,	5
547-5,	Sydney F. Haskell,	**Gloucester,**	H. J. Worth,	2
18-4,	John S. Mollison, Williamsburg.	**Goshen,**	- -	-
No telephone,	Rodney E. Bennett,	**Gosnold,**	- -	-

List of Forest Wardens and Local Moth Superintendents — *Con.*

Telephone Number.	Forest Warden.	Town or City.	Local Moth Superintendent.	Div. No.
- -	W. A. Getchell, North Grafton.	**Grafton,** . .	C. K. Despeau, .	5
3-13, . . .	C. N. Rust, . . .	**Granby,** . .	Chas. N. Rust, .	5
3-3, . . .	Harry A. Root, . .	**Granville,** . .	- -	-
327-W, . .	Daniel W. Flynn, . .	**Gt. Barrington,**	T. J. Kearin, .	5
439-M, . .	J. W. Bragg, . . .	**Greenfield,** . .	J. W. Bragg, . .	5
33-24, Enfield, .	Wm. H. Walker, Greenwich Village.	**Greenwich,** .	E. A. Sawtelle, .	5
71-5, . . .	Chas. M. Raddin, . .	**Groton,** . .	J. F. Bateman, .	4
2939-X, . .	Sidney E. Johnson, .	**Groveland,** . .	R. B. Larive, .	3
651-33, . .	Edward P. West, . .	**Hadley,** . .	Edw. P. West, .	5
5-2, Bryantville,	W. L. Robertson, . .	**Halifax,** . .	F. D. Lyon, .	7
128-W, . .	Fred Berry, Essex, R. F. D.	**Hamilton,** . .	E. G. Brewer, .	2.
5-14, . . .	Edward P. Lyons, . .	**Hampden,** . .	- -	-
17-F-2, . .	Chas. F. Tucker, . .	**Hancock,** . .	- -	-
51-5, Rockland, .	Chas. E. Damon, North Hanover.	**Hanover,** . .	L. Russell, . .	7
12-23,Bryantville,	Geo. T. Moore, South Hanson.	**Hanson,** . .	Geo. T. Moore, .	7
2-5, . . .	Henry J. Breen, . .	**Hardwick,** . .	Geo. J. Fay, . .	5
46-3, . . .	Benj. J. Priest, . .	**Harvard,** . .	G. C. Maynard, .	4
8000, . . .	John Condon, . . .	**Harwich,** . .	Arthur F. Cahoon,	8
34-2 . . .	Fred T. Bardwell, North Hatfield.	**Hatfield,** . .	Seth W. Kingsley,	5
4-2 or 4-1, . .	John B. Gordon, . .	**Haverhill,** . .	M. J. Fitzgerald, .	3
6-7, Charlemont,	Herbert A. Holden, .	**Hawley,** . .	- -	-
5-18, . . .	S. G. Benson, . . .	**Heath,** . .	- -	-
21305, . . .	Geo. Cushing, . . .	**Hingham,** . .	T. L. Murphy, .	7
20, . . .	Louis B. Brague, . .	**Hinsdale,** . .	- -	-
134-W, Randolph,	Melvin L. Coulter, .	**Holbrook,** . .	Bradford Parks, .	7
42-4, . . .	Winfred H. Stearns, Jefferson.	**Holden,** . .	W. H. Stearns, .	5
5-21, Brimfield, .	Oliver L. Howlett, Southbridge, R. F. D.	**Holland,** . .	A. F. Blodgett, .	5
1-2, . . .	W. A. Collins, . . .	**Holliston,** . .	Herbert E. Jones,	6
2295-W, . .	C. J. Healey, . . .	**Holyoke,** . .	T. A. Bray, . .	5
112-4, . . .	Walter F. Durgin, . .	**Hopedale,** . .	W. F. Durgin, .	5
Central, . .	R. I. Frail, . . .	**Hopkinton,** .	W. A. MacMillan, .	5
6-13, . . .	E. A. Young, . . .	**Hubbardston,** .	E. A. Young, .	5
132-M, . .	Wm. T. Greene, . .	**Hudson,** . .	F. P. Hosmer, .	4
248-W, . .	Smith F. Sturges, Allerton.	**Hull,** . . .	J. Knowles, . .	7
4-11, . . .	John J. Kirby, . .	**Huntington,** .	- -	-
148-W, . .	Pindar F. Bussell, . .	**Ipswich,** . .	J. A. Morey, .	2
15-3, . . .	Arthur B. Holmes, . .	**Kingston,** . .	R. F. Randall, .	8

List of Forest Wardens and Local Moth Superintendents — *Con.*

Telephone Number.	Forest Warden.	Town or City.	Local Moth Superintendent.	Div. No.
261-W,	Nathan F. Washburn,	**Lakeville,**	N. F. Washburn,	7
218-J,	Arthur W. Blood,	**Lancaster,**	L. R. Griswold,	4
1295-24,	King D. Keeler,	**Lanesborough,**	Geo. H. Judivine,	5
362,	Dennis E. Carey,	**Lawrence,**	I. B. Kelly,	3
66-3,	Jas. W. Bossidy,	**Lee,**	– –	–
37-5,	B. H. Fogwell,	**Leicester,**	J. H. Woodhead,	5
135,	O. R. Hutchinson,	**Lenox,**	T. Francis Mackey,	5
546 or 28,	Fred A. Russell,	**Leominster,**	D. E. Bassett,	4
9-44, Cooleyville,	O. C. Marvel, North Leverett.	**Leverett,**	H. W. Field,	5
480,	Robert Watt,	**Lexington,**	A. P. Howe,	1
289-11, Greenfield,	Jacob Sauter,	**Leyden,**	Wm. A. Campbell,	5
44-W,	J. J. Kelliher,	**Lincoln,**	J. J. Kelliher,	4
17-4,	A. E. Hopkins,	**Littleton,**	A. E. Hopkins,	4
6375-J,	O. C. Pomeroy,	**Longmeadow,**	– –	–
3400,	E. F. Saunders,	**Lowell,**	J. G. Gordon,	1
1-12,	H. A. Munsing,	**Ludlow,**	Ashley N. Bucher,	5
20,	Jas. S. Gilchrest,	**Lunenburg,**	James S. Gilchrest,	4
1174,	Geo. A. Cornet,	**Lynn,**	G. H. McPhetres,	2
– –	Andrew Mansfield, Jr., South Lynnfield.	**Lynnfield,**	L. H. Twiss,	2
– –	Watson B. Gould,	**Malden,**	W. B. Gould,	1
319-W,	Peter A. Sneahan,	**Manchester,**	P. A. Sheehan,	2
1-R or 1-W,	Herbert E. King,	**Mansfield,**	Marvin J. Hills,	6
226-W,	Wm. H. Stevens,	**Marblehead,**	W. H. Stevens,	2
117-2,	Geo. B. Nye,	**Marion,**	J. Allenach,	8
416 or 151-M,	E. C. Minehan,	**Marlborough,**	M. E. Lyons,	4
43-3,	Wm. G. Ford,	**Marshfield,**	P. R. Livermore,	7
31-2,	Darius Coombs,	**Mashpee,**	W. F. Hammond,	8
13-3,	Frank A. Tinkham,	**Mattapoisett,**	Webster Kinney,	8
138-3,	Geo. H. Gutteridge,	**Maynard,**	A. Coughlin,	4
106-4,	Waldo E. Kingsbury,	**Medfield,**	G. L. L. Allen,	6
53 or 138,	Chas. E. Bacon,	**Medford,**	W. J. Gannon,	1
34-3,	Phineas MacNutt, West Medway.	**Medway,**	F. Hager,	6
– –	– –	**Melrose,**	J. J. McCullough,	1
156-6, Milford,	Frank M. Aldrich,	**Mendon,**	F. M. Aldrich,	5
21-3,	Edgar P. Sargent,	**Merrimac,**	C. R. Ford,	3
229,	Herbert Nichols,	**Methuen,**	A. H. Wagland,	3
232-W,	W. H. Connor,	**Middleborough,**	A. D. Nelson,	7

List of Forest Wardens and Local Moth Superintendents — *Con.*

Telephone Number.	Forest Warden.	Town or City.	Local Moth Superintendent.	Div. No.
8003-2,	Thos. H. Fleming, Bancroft.	**Middlefield,**	– –	–
62-2,	Oscar H. Sheldon,	**Middleton,**	B. T. McGlauflin,	2
65-3,	Elbert M. Crockett,	**Milford,**	P. F. Fitzgerald,	5
– –	Harry L. Snelling,	**Millbury,**	E. F. Roach,	5
5-2,	Chas. LaCroix,	**Millis,**	E. W. Stafford,	6
322,	Nathaniel T. Kidder,	**Milton,**	N. T. Kidder,	7
No telephone,	S. R. Tower,	**Monroe,**	– –	–
12-22,	O. E. Bradway,	**Monson,**	Robert S. Fay,	5
713-22, Greenfield,	F. B. Gillette,	**Montague,**	Dennis F. Shea,	5
164-4,	D. C. Tryon,	**Monterey,**	– –	–
3-24, Russell,	Andrew J. Hall,	**Montgomery,**	– –	–
17-21, Copoke, N. Y.	G. W. Patterson,	**Mt. Washington,**	– –	–
– –	– –	**Nahant,**	T. Roland,	2
16-5,	Peter M. Hussy,	**Nantucket,**	C. C. Macy,	8
31,	Thos. J. Deignan,	**Natick,**	H. S. Hunnewell,	6
195-1,	Howard H. Upham,	**Needham,**	E. E. Riley,	6
No telephone,	Chas. L. Baker,	**New Ashford,**	– –	–
2280 or 353,	Edward F. Dahill,	**New Bedford,**	C. F. Lawton,	8
6-4, Gilbertville,	Frank A. Morse, West Brookfield.	**New Braintree,**	E. L. Havens,	5
13-6, Sheffield,	E. M. Stanton, Mill River,	**N. Marlborough,**	– –	–
Pay station,	Rawson King, Cooleyville,	**New Salem,**	R. King,	5
173-5, Newburyport.	Wm. P. Bailey,	**Newbury,**	Percy Oliver,	3
380,	Chas. P. Kelley,	**Newburyport,**	C. P. Kelley,	3
30, N. S.,	W. B. Randlett, Newton Center.	**Newton,**	W. W. Colton,	1
41-5,	Jas. T. Buckley,	**Norfolk,**	James T. Buckley,	6
205-W or 265,	H. J. Montgomery,	**North Adams,**	Franklin B. Locke,	5
821-W,	Geo. A. Rea,	**North Andover,**	Fred W. Phelan,	3
317-2,	Chas. F. Gehrung,	**N. Attleborough,**	F. P. Toner,	6
5-13,	Colby H. Johnson,	**N. Brookfield,**	S. D. Colburn,	5
33-3,	Henry Upton,	**North Reading,**	G. E. Eaton,	1
165,	F. E. Chase,	**Northampton,**	Christopher Clarke,	5
45-5,	T. P. Haskell,	**Northborough,**	T. P. Haskell,	5
71-5,	W. E. Burnap, Whitinsville.	**Northbridge,**	A. F. Whitin,	5
2-3,	Fred W. Doane,	**Northfield,**	F. W. Doane,	5
29-11,	Geo. H. Storer,	**Norton,**	G. H. Storer,	6
11-4,	John Whalen,	**Norwell,**	J. H. Sparrell,	7
55-4,	Frank W. Talbot,	**Norwood,**	Ebin F. Gay,	6

LIST OF FOREST WARDENS AND LOCAL MOTH SUPERINTENDENTS — *Con.*

Telephone Number.	Forest Warden.	Town or City.	Local Moth Superintendent.	Div. No.
119-4,	Frank W. Chase,	**Oak Bluffs,**	P. P. Hurley,	8
17-5,	Chas. H. Trowbridge,	**Oakham,**	C. H. Trowbridge,	5
67-13,	Frank M. Jennison,	**Orange,**	F. M. Jennison,	5
33-2,	James Boland,	**Orleans,**	A. Smith,	8
15,	Durand A. Witter,	**Otis,**	– –	–
9-5,	Olin D. Vickers,	**Oxford,**	C. G. Larned,	5
53-12 or 53-3,	James Summers,	**Palmer,**	C. H. Keith,	5
– –	Fred L. Durgin,	**Paxton,**	F. L. Durgin,	5
182-Y,	M. V. McCarthy,	**Peabody,**	J. J. Callahan,	2
144-3,	Edw. E. Adriance,	**Pelham,**	Marion E. Richardson.	
7-23, Bryantville,	Jos. J. Shepherd,	**Pembroke,**	J. J. MacFarlan,	7
54-3 or 12-5,	Geo. G. Tarbell, East Pepperell.	**Pepperell,**	J. Tune,	4
– –	Walter H. Pike,	**Peru,**	– –	–
13-2,	Geo. P. Marsh,	**Petersham,**	Daniel Broderick,	5
176-6, Athol,	Wm. Cowlbeck, Athol, R. F. D.	**Phillipston,**	W. H. Cowlbeck,	5
871-M,	Thos. F. Dumont,	**Pittsfield,**	– –	–
33-22,	Albert F. Dyer,	**Plainfield,**	– –	–
283-J, North Attleborough.	R. P. Rhodes,	**Plainville,**	Elmer Walden,	6
451-M,	Ira C. Ward,	**Plymouth,**	A. A. Raymond,	8
11-14, Kingston,	Thos. W. Blanchard,	**Plympton,**	D. Bricknell,	8
19-4, Highland,	A. W. Doubleday, Greenwich Village.	**Prescott,**	C. M. Pierce,	5
13-4,	Fred W. Bryant,	**Princeton,**	F. A. Skinner,	5
49-11,	J. H. Barnett,	**Provincetown,**	J. M. Burch,	8
1,	F. T. Billings,	**Quincy,**	A. J. Stewart,	7
35-4, Randolph,	R. F. Forrest,	**Randolph,**	Chas. Cole,	7
1284-R,	John V. Festing,	**Raynham,**	G. M. Leach,	6
518-W,	H. E. McIntire,	**Reading,**	H. M. Donegan,	1
11-12,	Benj. F. Monroe, Attleborough, R. F. D.	**Rehoboth,**	S. W. Robinson,	6
– –	– –	**Revere,**	G. P. Babson,	2
8-2,	T. B. Salmon,	**Richmond,**	– –	–
No telephone,	Daniel E. Hartley, Mattapoisett, R. F. D.	**Rochester,**	Edw. F. Handy,	8
55-X,	John H. Burke,	**Rockland,**	F. H. Shaw,	7
27-3,	A. J. McFarland,	**Rockport,**	F. A. Babcock,	2
22-6, Charlemont,	Merritt A. Peck, Zoar,	**Rowe,**	– –	–
3-13,	Daniel O'Brien,	**Rowley,**	L. R. Bishop,	3
279-2, Athol,	L. G. Forbes,	**Royalston,**	A. H. Brown,	5
8009-11,	S. S. Shurtleff,	**Russell,**	– –	–

List of Forest Wardens and Local Moth Superintendents — *Con.*

Telephone Number.	Forest Warden.	Town or City.	Local Moth Superintendent.	Div. No.
13-3,	Henry Converse,	**Rutland,**	H. E. Wheeler,	5
– –	– –	**Salem,**	Warren P. Hale,	2
1-8, Amesbury,	Jas. H. Pike,	**Salisbury,**	H. C. Rich,	3
202-12, Winsted, Conn.	A. S. Strickland, New Boston.	**Sandisfield,**	– –	–
43-2, Sagamore,	J. R. Holway,	**Sandwich,**	B. F. Dennison,	8
115,	Chas. L. Davies,	**Saugus,**	T. E. Berrett,	2
4-16,	Clinton Tilton, Brier,	**Savoy,**	– –	–
129-3,	E. R. Seaverns, North Scituate.	**Scituate,**	P. S. Brown,	7
399-L-5, Pawtucket.	John L. Baker, Attleborough, R. F. D.	**Seekonk,**	C. W. Thompson,	6
121-2,	A. Alden Carpenter,	**Sharon,**	J. J. Geissler,	6
26,	Arthur H. Tuttle,	**Sheffield,**	– –	–
130-2,	Chas. S. Dole, Shelburne Falls.	**Shelburne,**	Chas. S. Dale,	5
11-M,	Milo F. Campbell,	**Sherborn,**	J. P. Dowse,	6
16-21,	A. A. Adams,	**Shirley,**	A. A. Adams,	4
48-2,	Edward A. Logan,	**Shrewsbury,**	Robt. C. Clapp,	5
– –	N. J. Hunting,	**Shutesbury,**	E. Colfax Johnson,	5
2632-M., Fall River.	Wm. F. Griffiths, Swansea, R. F. D.	**Somerset,**	C. Riley,	6
– –	– –	**Somerville,**	A. B. Pritchard,	1
3164-W,	Louis H. Lamb, South Hadley Falls.	**South Hadley,**	C. R. Frye,	5
151-23,	C. S. Olds,	**Southampton,**	C. S. Olds,	5
13, Marlborough,	Harry Burnett,	**Southborough,**	H. Burnett,	5
11,	Aimee Langevin,	**Southbridge,**	A. Langevin,	5
8-2,	Benj. M. Hastings,	**Southwick,**	– –	–
77-4,	A. F. Howlett,	**Spencer,**	G. Ramer,	5
20,[1] Indian Orchard.	T. J. Clifford, Indian Orchard.	**Springfield,**	J. Alden Davis,	5
5-12,	Joel T. Wilder,	**Sterling,**	J. H. Kilburn,	4
Post Office,	Geo. Schneyer, Glendale,	**Stockbridge,**	Brown Caldwell,	5
176-3,	Albert J. Smith,	**Stoneham,**	G. M. Jefts,	1
121-3 or 8120,	James Curley,	**Stoughton,**	W. P. Kennedy,	7
134-J, Hudson,	W. H. Parker, Gleasondale.	**Stow,**	Henry W. Herrick,	4
6 21,	Chas. M. Clark, Fiskdale,	**Sturbridge,**	C. M. Clark,	5
5-5,	S. W. Hall, South Sudbury.	**Sudbury,**	W. E. Baldwin,	4
46,	A. C. Warner,	**Sunderland,**	Richard Graves,	5
58-32, Millbury,	R. H. Richardson,	**Sutton,**	Ransom H. Richardson.	5
1911-J,	E. P. Mudge,	**Swampscott,**	E. P. Mudge,	2
468-W,	Thos. L. Mason,	**Swansea,**	A. E. Arnold,	6
320 or 1-W,	Fred A. Leonard,	**Taunton,**	L. W. Hodgkins,	6

LIST OF FOREST WARDENS AND LOCAL MOTH SUPERINTENDENTS — *Con.*

TELEPHONE NUMBER.	Forest Warden.	Town or City.	Local Moth Superintendent.	Div. No.
30 or 26-5, . .	C. A. Fletcher, Baldwinsville.	**Templeton,** .	J. B. Wheeler, .	5
4249-J, Lowell, .	Harris M. Briggs, . .	**Tewksbury,** .	H. M. Briggs, .	1
161-4 or 102-3, .	Elmer C. Chadwick, Vineyard Haven.	**Tisbury,** . .	H. W. McLellan, .	8
No telephone, .	C. L. Vining, . . .	**Tolland,** . .	– –	–
Central, . .	Chas. W. Floyd, . .	**Topsfield,** . .	C. W. Floyd, .	2
11-2 or 37-2, .	F. J. Piper, . . .	**Townsend,** . .	G. E. King, . .	4
No telephone, .	Walter F. Rich, . .	**Truro,** . . .	J. H. Atwood, .	8
1, . . .	Otis L. Wright, . .	**Tyngsborough,** .	C. J. Allgrove, .	1
1-2, Lee, . .	H. E. Moore, . . .	**Tyringham,** .	– –	–
7-2, . . .	E. M. Baker, Upton Center.	**Upton,** . .	G. H. Evans, .	5
51-5, . . .	Lewis F. Rawson, . .	**Uxbridge,** . .	Willard Holbrook,	5
455-M or 59, .	Wm. E. Cade, . . .	**Wakefield,** . .	W. W. Whittredge,	1
No telephone, .	Warren W. Eager, . .	**Wales,** . . .	M. C. Royce, .	5
107-2, . . .	J. J. Hennessy, . .	**Walpole,** . .	P. R. Allen, . .	6
6, . . .	Geo. L. Johnson, . .	**Waltham,** . .	W. M. Ryan, .	1
203-3, . . .	Louis A. Charbonneau, .	**Ware,** . . .	F. Zeissig, . .	5
45-23, . . .	Delbert C. Keyes, South Wareham.	**Wareham,** . .	J. J. Walsh, . .	8
46-6, . . .	Jos. D. Vigneaux, West Warren.	**Warren,** . .	A. A. Warriner, .	5
73-3, Orange, .	Chas. A. Williams, . .	**Warwick,** . .	Chas. E. Stone, .	5
12-4, . . .	Lester Heath, . . .	**Washington,** .	– –	–
116, Newton North.	John C. Ford, . .	**Watertown,** .	J. C. Ford, . .	1
– –	William Stearns, . .	**Wayland,** . .	D. J. Graham, .	4
113-4, . . .	Timothy Toomey, . .	**Webster,** . .	C. Klebart, . .	5
– –	John P. Doyle, . .	**Wellesley,** . .	F. M. Abbott, .	6
No telephone, .	John Holbrook, . .	**Wellfleet,** . .	E. S. Jacobs, .	8
74-32, Orange, .	Lewis B. Bowen, Wendell Depot. .	**Wendell,** . .	G. E. Mills, . .	5
74, Hamilton, .	Jacob D. Barnes, . .	**Wenham,** . .	Jas. E. Kavanagh,	2
3-21, . . .	Fred E. Clark, . .	**West Boylston,** .	R. K. Parker, .	5
768, Brockton, .	W. P. Laughton, . .	**W. Bridgewater,**	O. Belmore, . .	7
37-13, . . .	J. H. Webb, . . .	**W. Brookfield,** .	J. H. Webb, . .	5
5-6, . . .	Louis H. Flook, . .	**W. Newbury,** .	Frank D. Bailey, .	3
2067-W, . .	Dana S. Moore, . .	**W. Springfield,** .	Geo. W. Hayden, .	5
1-6, . . .	Benj. P. Bissell, . .	**W. Stockbridge,**	– –	–
203-23, . .	Wm. J. Rotch, . .	**West Tisbury,** .	H. W. Athearn, .	8
75-3, . . .	Thos. H. Treadway, .	**Westborough,** .	Geo. Hayden, .	5
111-Y, . .	T. H. Mahoney, . .	**Westfield,** . .	– –	–
44-11, . . .	Harry L. Nesmith, . .	**Westford,** . .	H. L. Nesmith .	1

List of Forest Wardens and Local Moth Superintendents — *Con.*

Telephone Number.	Forest Warden.	Town or City.	Local Moth Superintendent.	Div. No.
148-14, Easthampton.	C. A. Bartlett, Northampton, Stage.	**Westhampton,**	– –	–
1-3,	Windsor F. Neal,	**Westminster,**	G. A. Sargent,	5
1392-M,	Benj. R. Parker,	**Weston,**	E. P. Ripley,	4
14-21,	Frank Whalon,	**Westport,**	H. A. Sanford,	8
123-M, Dedham,	Elmer E. Smith, Islington,	**Westwood,**	Martin Sorenson,	6
154-W,	Edgar S. Wright,	**Weymouth,**	C. L. Merritt,	7
69-2, South Deerfield.	James A. Wood,	**Whately,**	Rylan C. Howes,	5
104-14,	C. A. Randall,	**Whitman,**	C. A. Randall,	7
1-4,	Henry I. Edson,	**Wilbraham,**	F. B. Metcalf,	5
4-11,	J. A. Breckinridge,	**Williamsburg,**	– –	–
34-14,	William Davies,	**Williamstown,**	Wm. Davies,	5
34-4,	Howard M. Horton,	**Wilmington,**	O. McGrane,	1
29,	Arlon D. Bailey,	**Winchendon,**	G. W. Drury,	5
123-2,	David H. DeCourcy,	**Winchester,**	S. S. Symmes,	1
201-12, Windsor,	Amos Ferry,	**Windsor,**	– –	–
– –	– –	**Winthrop,**	M. F. Smith, Jr.,	2
110,	Frank E. Tracy,	**Woburn,**	J. H. Kelley,	1
7112, Park,	Arthur V. Parker,	**Worcester,**	H. J. Neale,	5
10-22,	Chas. Kilbourn,	**Worthington,**	– –	–
23-5 or 8037,	Geo. H. E. Mayshaw,	**Wrentham,**	W. Gilmore,	6
53-33,	Jos. W. Hamblin,	**Yarmouth,**	C. R. Bassett,	8

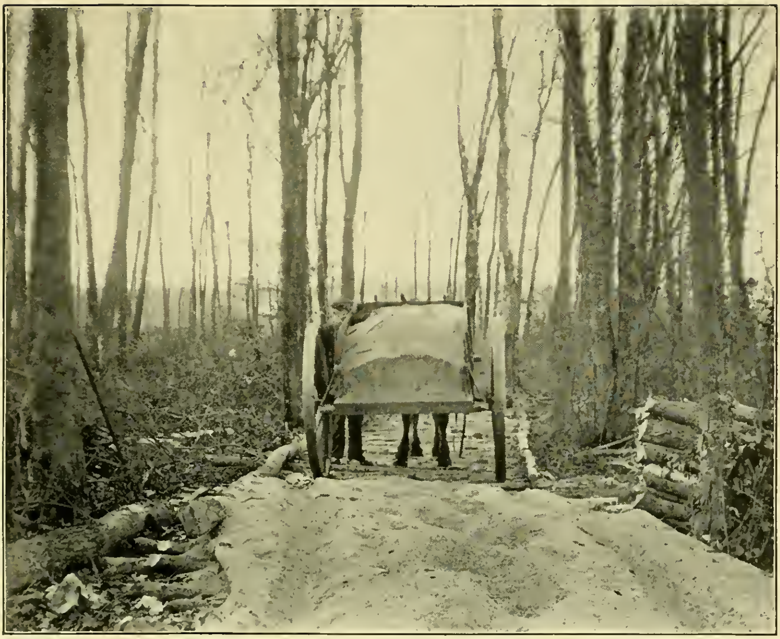
The Application of Forestry to Moth Work.

The work of applying forestry practice to the control of the gypsy moths has proceeded steadily and with gratifying success during the past year. This work was started hardly two years ago, and has grown until it is now one of the most important features of the activities of the department. The theory of the work as outlined in the last annual report — the removal from our woodlands as much as possible of the favorite food trees of the moths, and the substituting and encouraging of species more resistant to the moth attacks — has been confirmed by the test of actual practice. In the methods of carrying on the forestry operations, and in the utilization of the resulting products, great advances have been made during the past year.

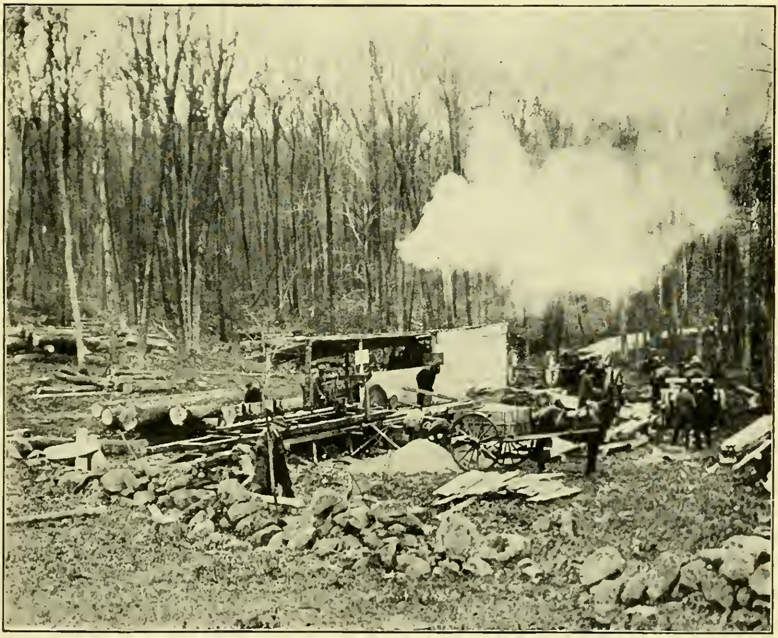
The combating of moths in shade trees, orchards and parks is a different problem from their control in wild woodland. In the first case the chief value of the trees is in their beauty or fruit-producing capacity. Such trees are much more valuable than trees which are allowed to grow chiefly for the wood they will produce when cut, as is the case with forest trees. Therefore, it is possible to use much more expensive methods in controlling moth infestations on the valuable shade trees than in the relatively valueless forest trees. That is the reason why the forestry methods of control, which call for the cutting of individual trees rather than the saving of them, were established. Undoubtedly it would be possible to save most of our forest trees by using shade-tree methods, — by spraying, etc., — but the trees thus saved would not be worth the cost, and there is not enough money to do it. It would cost millions of dollars a year.

In Europe, where these moths have existed from time immemorial, less than 5 per cent. of the forest growth is of oak. In eastern Massachusetts fully 50 per cent. is of oak. We must get approximately the European proportion in this country before we can expect the natural agencies of parasites, disease and birds to control the moths as they do in Europe. If left alone the moths will do this by themselves and kill off most of the oak, leaving the resistant species to grow up in its stead. By cutting the oak we can hasten the process and prevent the tremendous economic waste that would follow the killing of the oak. We can also prevent the desolation and fire risk which would accompany the killing. We know this is true, for we already have several thousands of acres of dead oak in the State. Proper cuttings made before the infestation becomes too serious will materially check moth spread. Taken after serious eating the cutting will merely lessen the resulting loss and hasten the return of the land to forest conditions.

These moth thinnings are being carried on directly by the owners either in co-operation with the State or by themselves, rather than through the agency of the town authorities, as is the case of most of the other moth work. However, in many towns the local men are giving splendid aid in this work. Most of the towns have a sufficient financial burden in taking care



Stevens estate, North Andover. Putting sawdust on corduroy road used in logging.



Portable mill in operation on Stevens estate, North Andover. Process of rebuilding a hardwood forest injured by moths to one of white pine, which is moth resistant.

of their shade trees and roadsides. They have not the time nor the money to continually take care of the wild woodland. For owners who are willing to furnish the capital, the policy of this department has been to take complete management of the work, cutting the trees necessary to the best possible advantage, and selling the product afterwards. For other owners we have found buyers for the wood which we wanted cut, or have given advice and marked trees, etc., and left them to manage the cutting themselves. Many others have followed the example of the owners whom we have helped, and have done the thinning of their own accord.

The attempt in this work has been to put it on a firm business basis. The areas of large growth that have been cut have been lumbered according to the most modern methods, as would be done by any large lumber company. The smaller growth has been cut by the cord at the market price. Except where beauty or moth spread were factors, the owners have not been urged to carry on this work unless they could see before they started that it would at least pay for itself. The subject of utilization has been gone into most thoroughly. All the large wood dealers and brick yards have been called on, with the aim of persuading them to buy the wood which we have and will cut. New methods of utilization, such as chemical wood, charcoal, etc., have been studied. All the industries and dealers who use and buy oak lumber or logs have been written to, and many of them visited, in an attempt to find out what they want, so that the owners who cut may sell their product to them to the best advantage. In short, this office has been made a sort of clearing house for oak products, where the buyer and seller may meet.

As in the year previous, an attempt was made to get a complete list of all owners of infested woodland in the State. Many of these owners have since been written to and visited in an attempt to persuade them to practice forestry methods on their lands. Maps have been kept showing the infested areas, and also all lands examined. A card index of all owners to whom advice is given is also kept describing their peculiar conditions, and the attempt will be made to follow them up in future years; also an index of all oak buyers is maintained.

The educational and technical sides of the work have not been forgotten. A bulletin on thinning was published during the year and is being widely distributed. It tells how to do the work and contains many practical data. Any who have not received a copy and who are interested are invited to apply for one, which will be mailed without charge. Accurate cost data of all operations carried on under our management are being kept. We are now collecting data for an oak log rule, and also volume and yield tables, which we hope will be quite a contribution to technical forestry. Several towns in the moth-infested section were mapped this past summer in an endeavor to find out the exact forest and moth conditions. These maps will prove very valuable in carrying on the practical work.

This winter there are four trained foresters giving their whole time to this work, — two in the Boston office, one resident in the southeastern section, and one working on the technical data. On December 1, we had under our management five crews working on these thinnings in different sections of the State, including two portable saw mills. Before the winter is over we expect to have double that number of crews and mills at work. Besides that, there are a good many more engaged in thinning under our advice or stimulus, although not directly managed by this office. Several thousand acres will be thinned over this winter, and at least 20,000 cords of wood cut, also 2,000,000 or 3,000,000 feet of lumber and ties, making a total expenditure of private funds of probably $75,000.

It is hard to make a report at this time because the operations are in full swing, and the work reported on is incomplete and so accurate figures cannot be given. Following is an attempt to tabulate just what has been accomplished from Dec. 1, 1913, to Dec. 1, 1914: —

Examinations. — The lands of 204 owners were examined by experts from this department, advice given, and in many cases detailed reports written. The total area included in these examinations was approximately 17,000 acres, situated in 81 towns or cities of the State.

Operations. — The following is a list of the thinning and cutting operations carried on during the past year, either under the direct management of this department or under its immediate supervision. Some of these operations were started before the year covered by this report and finished within the year, while others are now started but will not be completed until 1915. There are a total of 25 operations covering an area of 1,103 acres.

Owner.	Town.	Area (Acres).
Miss Edith Andrew,	Hingham,	4
Charles B. Barnes,	Hingham,	30
George H. Barton,	Stow,	12
Mrs. Alexander Churchward,	Boxford,	30
Erskine Clement,	Haverhill,	9
Mrs. Abby G. Davis,	North Andover,	6
Miss C. A. French,	North Andover,	35
Walter P. Frye,	Hudson,	12
A. H. Hodgdon,	Westwood,	12
Karlstein Estate,	Dedham,	82
Mrs. Alfred Rodman,	Dedham,	80
New Bedford Water Works,	Middleborough and Rochester,	300
Howard Marston,	Barnstable,	35
Province Lands,	Provincetown,	80
F. P. Royce,	Dedham,	2
W. E. Schrafft,	Weston,	60
J. Duke Smith,	Medfield,	10
Nathaniel Stevens,	North Andover,	110
Nathaniel Stevens,	Boxford,	15
United States Naval Magazine,	Hingham,	60
Mrs. S. C. Wheelwright,	Cohasset,	10
W. A. Whitcomb,	Dedham,	32
Mrs. D. P. Wight,	Dedham,	2
Arthur Winslow,	Middleborough,	35
W. P. Wharton,	Groton,	40

Besides these operations many have been carried on under the supervision of the district moth superintendents, and many more under the advice of this department without further assistance.

Of the operations listed, 428 acres were actually cut over during the fiscal year of 1914. On them 4,718 cords of wood were cut, 286 piles, 148 posts and 385 thousand feet of lumber, including railroad ties which would number about 4,000. On this work the owners have spent $17,327.42, and the State has contributed merely the salary and traveling expenses of the forester managing and supervising.

Utilization. — One of the important parts of the work has been the disposal and sale of the wood cut in these thinnings. Besides selling the wood cut under our direct supervision we have attempted to aid owners who have cut on their own responsibility. This past year we have negotiated sales to the amount of nearly $5,000. We have contracts for products worth about $20,000, which will be filled as soon as delivery can be made. The owners themselves have sold about $4,000 worth of wood which was cut under our direction. There remains to be sold about $10,000 worth of wood which is already cut. Much of this will be sold as soon as it becomes dry enough to be merchantable.

These results are only a beginning in what must be accomplished in the woodlands of the State. The encouraging features are, first, that most of these operations have been on a paying basis. Only a few of them have resulted in any net expense to the owner. Most of them have shown a profit. From the $17,300 spent last year the returns should be over $23,000, a profit of $5,000. This work has proven that the moths can be attacked in the woodland without the expenditure of large sums of money, as is necessary in the other methods of moth control. The one great need is of capital to finance these operations. The poor man who owns woodland may not be able to do this work, which will yield a profit in the end, because he cannot pay for the wood chopping. However, we hope to overcome this difficulty in a large measure in the future by finding purchasers for the wood before it is cut. Second, this work is on a practical and common-sense basis, and cannot help appealing to the ordinary citizen. Third, this work will result in better and more valuable forests for the Commonwealth in the future. The pine, which is the natural and more valuable species for the land, is being made to supplant the oak, which is not best suited for most of the land on which it grows, and which is worth only a tenth as much.

Furthermore, these operations stand as practical and easily accessible object lessons in the practice of forestry, and are awakening great interest in the subject among many of our citizens. Mr. Kneeland and the young men assisting him in this work are accomplishing a great amount of constructive moth and forestry work that is bound to prove of great future economic value.

Forest Mapping.

This last season the field work of the forest survey of Worcester County towns has been completed save for a portion of Hubbardston, which will have been finished shortly after this report goes to the printer.

A very thorough forest map of Winchendon, showing the character of growth on every portion of the town, was made in co-operation with the United States Bureau of Entomology. Mr. Ingall, of the United States Bureau of Entomology, and Mr. C. H. Guise, surveyor for this office, did the field work of forest mapping, being accompanied by Mr. Wilcox and Mr. Schaffner, respectively, experts from the United States Entomological Laboratory, who collected data for classifying and mapping areas according to their susceptibility to gypsy moth infestation. The field work was done by running the paced compass lines from one town line to the other every quarter mile, instead of every half mile as has been done in other towns. This quarter-mile strip in the field enabled Mr. Ingall to complete a very satisfactory detail working map showing in different colors the different combination of species. It is hoped the town will use this in eradicating the gypsy moth food, which would prove at the same time a long step towards converting the large woodland area of the town into a coniferous forest, practically immune from the gypsy moth. It is to be hoped that the town of Winchendon will co-operate with the Federal and State governments in this, since it would not only prove a valuable experiment on a large scale with gypsy moth conditions, but would make the woodland areas of Winchendon vastly more valuable than at present by converting large areas of practically worthless growth into pine. For Winchendon we have figures showing in detail the area in practically every combination of species for different sizes of growth.

Owing to serious insect conditions in Plymouth County it was thought best to begin mapping and estimating there before completing Worcester County. Five towns of Plymouth County were covered, approximately one-third the area of the county. The towns are Brockton, Hingham, Hanover, Middleborough and Carver.

For the Plymouth County work we have used, instead of pantographic enlargements, photographic enlargements of the United States Geological Survey maps, the scale being approximately 1 inch to 2,000 feet. This should prove a very satisfactory standard map for all the woods work of the different branches of the department. The cost of the maps is several dollars a town less than the old process, and the maps are far more satisfactory. Adopting this process and standard scale for all field maps should save the State many thousands of dollars. We acknowledge our indebtedness to Forester W. O. Filley of Connecticut for a valuable suggestion in connection with this process.

While figures of acreage estimates, and the estimate maps, are available for practically all the towns covered individually, they have not yet been tabulated for comparison. This should be completed in a few weeks, and shortly thereafter we hope to have the estimate maps colored, and to have them on file at the office easily accessible so that any one can get an idea visually of the character of growth in any section. It might be said here that our figures show forested areas of the towns averaging about 60 per cent., with forested areas of some towns as high as 80 per cent.

Another season we may try mapping forest areas from automobile, with the half-mile strip method used only on every fifth town. While much less satisfactory, especially unless done by a very capable man, the automobile mapping would be very much quicker and cheaper. By having every fifth town worked by the strip system, fairly accurate detail figures could be obtained for each county as a whole.

This mapping work has been done under the supervision of Mr. Harold Fay, who has also assisted in other important general forestry work as occasion demanded.

FOREST MANAGEMENT.

The increasing interest being shown each year by woodland owners in connection with the management of their holdings according to now well-established forestry principles is very encouraging [illegible] requests have come in continually during the past season from owners desiring an examination of their forest property, and advice as to its proper management. These requests have been attended to in the order in which they have been received, and in every case a trained forester has made an examination and given either verbal or written advice in regard to the management of the property. A list of these examinations for the season just ended is as follows: —

NAME.	Location.	Area (Acres).
Appalachian Mountain Club,	Warwick,	42
R. H. Howe,	Worcester,	4
E. M. Chase,	Holyoke,	10
David Carrick,	South Royalston,	10
W. B. Cross,	Halifax,	140
W. B. Cross,	Brockton,	15
E. H. Pratt,	North Adams,	85
C. O. Prescott,	Westford,	500
A. R. Sharp,	Taunton,	75
State Board of Agriculture,	South Walpole,	400
E. L. Gillett,	Westfield,	300
Indian Spring Camp,	Plainfield,	250
Greenfield Women's Club,	Greenfield,	20
Mansfield Water Board,	Mansfield,	200
Metropolitan Water Board,	Northborough,	160
Nevins Library,	Methuen,	1
Mount Hermon School,	Gill,	50
Northampton Water Board,	Northampton,	30
Miss M. Deane,	East Taunton,	3
Northfield Seminary,	Northfield,	150
Hopedale Park Board,	Hopedale,	75
Irving Smith,	Ashburnham,	3,500
Tax Commission,	Williamstown,	1,000
Miss F. True,	Salisbury,	50

NAME.	Location.	Area (Acres).
C. L. Wilder,	Lancaster,	190
L. E. Bassett,	Southville,	210
Geo. Blake,	Lenox,	250
Walpole Park Board,	Walpole,	300
Mrs. A. W. P. Crocker,	Foxborough,	80
Dr. V. C. Pond,	Foxborough,	105
G. M. Deane,	Coldbrook,	75
A. Sedgewick,	West Stockbridge,	300
J. M. Heald,	Lincoln,	20
H. W. Smith,	North Grafton,	150
W. A. Gaston,	Barre,	100
Mr. Tucker,	Acton,	30
Dr. Cady Phipps,	Sherborn,	25
Boylston Manufacturing Company,	Jefferson,	42
D. W. Gaskill,	Blackstone,	143
Miss C. Hosmer,	Orange,	200
Foxborough Water Board,	Foxborough,	75
Miss Harriet Ames,	Shutesbury,	125
E. C. Wood,	Northfield,	50
State Colony,	Gardner,	1,600
State Colony,	North Grafton,	900
Worcester Country Club,	Worcester,	40
Alice H. Marsh,	Sturbridge,	10
B. Curtis,	Medfield,	40
F. O. Houghton,	Millis,	100
Mrs. M. B. Cutting,	Sudbury,	80
Miss Sarah Pratt,	Sudbury,	200
George Timmons,	Ware,	350
C. K. Ellis,	Carlisle,	20
John White,	Freetown,	65
Wellesley College,	Wellesley,	60
State Fish and Game Farm,	Palmer,	200
Blanche M. Brine,	Manomet,	40
Geo. A. Brooks,	Manomet,	10

Total number of examinations, 58; area covered, 13,255 acres; expense to owners, $124.45.

Thinnings.

The department's work in connection with woodland thinnings has shown an increase this year over last. In some cases, and where so desired by the owner, this department has taken charge of the thinning operations from beginning to end, while in other cases the trees to be removed have been marked and the owners have supervised the remaining work themselves. Some of the places that have received attention this year are as follows: —

Wellesley College. — A heavy marking in the trees on about 60 acres was made during the fall. The marked trees are to be removed by the grounds superintendent and his men this winter. Stumps are to be cut low, brush burned, and the area will be in suitable condition in the spring to stock with conifers if the authorities desire to do so. The trees to be removed are mostly white oaks.

St. Augustine Farm. — Work was started last winter and is being continued at the present time on the 125-acre property known as the St. Augustine Farm, located in Foxborough, Mass. The operation consists of heavy, medium and light thinnings, clean cutting in places to be followed by planting. A fire line 75 feet wide and 2,000 feet long has been made during the past two months. The woodland consists of large, medium and small white pine and mixed hardwoods. One small stand of planted pine about twenty years old is making excellent growth.

Alfred Mellor Property. — This operation is continued from last season, and is at present under way on the 200-acre tract of Alfred Mellor, located in Cummington, Mass. It consists of a thinning in conifer and mixed hardwood growth, and is of especial interest on account of the very large size of many of the trees involved. There are several hemlocks on the tract that will run over 1,000 board feet per tree, and very large maples are numerous. Trees of such size are unusual in Massachusetts at the present time, and give one an idea of what the original forest of the State was like.

Mrs. W. A. P. Crocker. — This 80-acre tract, located in Foxborough, Mass., consists of one of the best pine stands remaining in the section. About 50 acres is stocked with pure white pine of all ages up to ninety to one hundred years of age. A camp has been erected and a crew has been in the woods for the past three months removing marked trees. Several thousand feet of lumber have been cut from this tract up to date, and it is believed that, aside from putting the area in much better condition, the operation will show a profit to the owner. All wood products are to be used at the owner's mill. On this tract, also, is a planted stand of white pine twenty-two years old that is making good growth. Planted pine thirty-five to forty years old is also to be seen.

Boylston Manufacturing Company. — A thinning and clean-cutting operation is at present in progress on the 45-acre tract in Jefferson, Mass., owned by the Boylston Manufacturing Company of Easthampton. The thinning and clean cutting is to be followed by planting to pine in the spring. This operation is of interest as an indication that large business concerns owning forest land are beginning to realize that it is not good business policy to allow their holdings to remain idle and neglected.

Fire Line.

On the W. B. Cross property in Brockton, Mass., a fire line nearly 1 mile long and 60 feet wide has been made during the past two months. This fire line follows the highway for the entire distance, and in conjunction with the road itself makes an excellent line of protection against fire for the property of Mr. Cross. All brush was clean cut and burned.

Other places where the trees have been marked and work is to be done this winter are as follows: —

Name.	Location.	Area (Acres).
W. A. Gaston Estate,	Barre,	20
Worcester Country Club,	Worcester,	40
H. W. Smith,	North Grafton,	100
State Hospital,	Taunton,	50
State Hospital,	North Grafton,	400
State Hospital,	Gardner,	1,000
Geo. Timmons,	Ware,	350
E. F. McSweeny,	Lake Boone,	5

This department is pleased to note that some of the State institutions are inaugurating a forest policy for their woodland property. This year something along forestry lines is being done on the woodland of the Taunton, North Grafton and Gardner State hospitals for the insane. It has been proven that the able-bodied men inmates of the insane institutions can do very well the needed work in the woodland areas owned by the various institutions, and thereby benefit not only the woodland and institutions, but themselves as well, for the forest work makes a very healthful occupation. At the Gardner colonies alone there are 75 or 80 inmates who will be employed this winter in improving the woodland areas of that institution. There are 600 or 700 acres of blank, or what is termed as absolute, forest land that can and should be planted with conifers during the next few years. This work can all be done by the inmates. It is planned to establish a nursery in the spring at the Gardner Colony that will stock 100,000 transplants a year for the next six years. The seedlings will be furnished by the department's nursery at Amherst.

The department is pleased to assist the various State institutions in any way in connection with the better management of their forest property. The combined areas of the various State institutions amount to thousands of acres, and it is certain that were a definite forest policy followed up on these areas much good would result.

Walpole Town Forest.

It is quite probable that during the coming year a definite start will be made towards establishing a permanent town forest in Walpole, Mass. The proposition has been considered by Mr. Charles Sumner Bird, Jr., chairman of the park board, and other citizens of the town during the past few months. A survey of 200 acres has been made, 100 acres more examined, and data collected in connection with the town forest plan, and it is hoped an appreciable start will soon be made in the matter. That a town forest is an excellent and valuable asset to a town cannot be disputed. There are many towns throughout the Commonwealth that have right at their very doors, so to speak, the property suitable for the making of excellent town forests, and it is hoped that during the next few years many towns will make a start along this line.

Surveys.

The following is a list of the lots taken over for reforestation: —

NAME.	Location.	Area (Acres).
Eleanor Johnson,	North Adams,	100
Marcus M. Brown,	Marlborough,	90
Harmon & Thayer,	Savoy,	35
W. G. Perry,	Medfield,	26
W. G. Perry,	Medfield,	12
W. G. Perry,	Medfield,	3

Surveys were also made of the St. Augustine Farm in Foxborough and of the Crocker lot in Foxborough.

Working Plans.

A working plan was made this year for the property of Irving Smith. This property consists of 3,350 acres in Ashburnham and 50 acres in Winchendon. The complete plan consists of (1) an examination, with estimates and recommendations in the form of a typewritten report; (2) a forest map covering the entire tract, based upon a lot survey by a professional surveyor and a timber survey by this office; and (3) a large scale detail map showing the areas recommended for treatment during the next ten years. The growth was divided into types, each of which was estimated separately. The general recommendations were made covering cutting, thinning and planting.

Specific recommendations were also made, to be followed closely for the first ten years, but subject to revision in the future to meet varying conditions.

If possible, working plans will be made during the summer of 1915 for the 1,600-acre tract of the State Colony at Gardner and the 900-acre tract of the State Colony at North Grafton. A certain amount of data has been procured in connection with a plan for the Fish and Game Farm of 200 acres in Palmer.

Extracting seed from pine cones, Fall River water commission, on Watuppa Reservation.

Fifty-six year old plantation of white pine, Sharon, Massachusetts. Will yield about 40,000 board feet to the acre. Our waste lands can be made to yield thus if replanted to pine.

Maps.

All unfinished maps were completed during the year. At the present time a large line map is being made for the use of observation stations in connection with forest fire work. Pocket field maps are also being made for use during the coming season.

NURSERY WORK.

Our principal advance in nursery work this past season was the leasing of 7 acres of remarkably fertile soil in the village of Barnstable. In the early spring a portion of the ground was cleared and plowed, and 300 12 by 4 feet seed-beds were placed in position. These beds are of the latest type wooden frames, with wire sides and a combined wire and lath cover screen. In addition, some 200,000 pine, spruce and ash were set in as transplants. The seed-beds have shown remarkable germination, and will produce an immense crop of two-year seedlings one year hence. Water is supplied by a gasoline engine pumping from a well to an elevated tank. A small but neat building to serve as a camp for the men and a storehouse for tools was also erected. Only one-half of the 7 acres is at present in use, but by next spring the entire area will be ready for transplanting.

The nursery at Sandwich, which, owing to the sandy soil and the difficulty of getting water, was unsuccessful, has been discontinued.

We also did no further transplanting at Hopkinton, where we have in the past set in some surplus stock that could not be accommodated at Amherst.

The nursery which we operate in co-operation with the State Farm at Bridgewater this spring suffered severely from frost heaving. We lay this to two causes, — fall transplanting and the rawness of the soil, which had just been newly cleared and never cultivated. We shipped 100,000 seedlings to take the place of those heaved out, and do not anticipate that the same trouble will occur again. If it does, another site can be selected for future work.

The Amherst nursery has been our main source of supply during this year, as it has been in the past. One hundred and fifty of the latest type seed-beds have been installed, and water conditions improved by the laying of a larger main from the college grounds to the connection with our nursery. A telephone also aids materially in the transaction of business.

Three classes of stock are shipped from our nursery. The first is for use on the lots which we have taken over under the reforestation law, and is largely transplanted material. The second class goes to other State institutions, which under the nursery law we furnish with forest planting stock, and is partly transplanted and partly seedling material, according to whether it is intended for use in the field or for the transplanting in their own nurseries. The third class is seedling material which we send to our nurseries for transplanting.

Stock for planting on Reforestation Lands.

White pine (four-year transplants),	390,000
White pine (three-year transplants),	210,000
Norway spruce (three-year transplants),	16,000
White ash (two-year seedlings),	5,000
European larch (two-year seedlings),	6,000

Stock shipped to Other State Departments.

Metropolitan Park Commission (two-year seedlings),	200,000
Metropolitan Water Board (two-year seedlings),	300,000
Fisheries and Game Commission (two-year seedlings),	50,000
Fisheries and Game Commission (three-year transplants),	3,000

Reforestation Work.

The lands taken over under the terms of the reforestation law can be divided into two classes. The first is land purchased outright by the State, which it is probable it will hold as a permanent investment, and the second is land which private owners have deeded to the State without cost, for the purpose of having the State Forester plant and care for it for a period not to exceed ten years, when they will redeem the land by paying the cost of reforesting and maintenance. The first we call purchased lands, and the second deeded lands.

Reforestation work usually partakes of two operations, — planting and brush cutting. On old pasture land, and often on cut-over pine land where sprout or bush growth does not come in very rapidly, planting is the only work necessary, but in cut-over hardwood land, or on very brushy pastures, it is necessary to clear the brush in whole or in part either before or after planting. As a usual thing such brush clearing is not done until a year or two after the planting, because the shade of the sprouts is a useful factor of protection for the newly planted pines. However, where sprout growth is exceedingly dense it must be cleared before planting can be attempted.

It is evident from the above that in addition to the new work carried out each year there must be more or less done along the lines of maintaining and improving the growing plantations. Not only must the growing pines be freed from encumbering hardwood sprouts, but blanks in the stand due to drought or other causes must be filled in and losses by fire made good. Fences must be repaired and kept up. We are glad to say, however, that fire losses have been comparatively few. During the past year we have lost through fire one lot of 20 acres in Dennis and one of 15 acres in Oakham.

New Work, 1914.

Purchased Lands.

Owner.	Town.	Area (Acres).	Number of Trees planted.	Brushed (Acres).
Fenno,	Westminster,	100	85,000	100
Fiske,	Buckland,	75	70,000	25
Rice,	Spencer,	40	50,000	-

Deeded Lands.

Owner.	Town.	Area (Acres).	Number of Trees planted.	Brushed (Acres).
Irving Smith,	Ashburnham,	150	70,000	-
Eben Smith,	Barnstable,	17	20,000	17
Webster,	Warwick,	50	51,000	-
Lewis,	Groton,	18	14,000	-
Johnson,	North Adams,	100	50,000	5
Baker,	Phillipston,	10	11,000	-
Perry,	Medfield,	35	15,000	-

MAINTENANCE WORK.

Lot Number.	Town.	Area (Acres).	Nature of Work.
75	Oakham,	18,000[1]	Filling in blanks.
91	Spencer,	20,000[1]	Filling in blanks.
11, 12	Spencer,	60	Brushing.
22	Hubbardston,	10	Brushing.
26	Templeton,	60	Brushing.
6	Templeton,	30	Brushing.
37	Templeton,	50	Brushing.
53	Hubbardston,	25,000[1]	Replanting.
3	Hubbardston,	15,000[1]	Filling in.
16	Westminster,	30[2]	Brushing and filling in.
38	Ashburnham,	20	Brushing.
8	Ashburnham,	4	Brushing.
80	Rutland,	6,000[1]	Filling in.
74	Dover,	14	Brushing.
7	Andover,	20	Brushing.
25	Rowley,	8	Brushing.
114	Manchester,	5	Filling in.
50, 51	Hopkinton,	30[3]	Brushing and filling in.

[1] Number of trees used in filling in. The area covered would vary greatly on different lots.
[2] 10,000 trees used in filling in.
[3] 20,000 trees used in filling in.

To summarize the above tables: along the line of new work, planting equals 500 acres and brushing, 150 acres; in the line of maintenance, planting is equivalent to 115 acres and brushing to 340 acres.

When we say the planting is equivalent to 115 acres we mean that the number of trees used in filling in, if planted 6 by 6 feet apart, would cover that area. The actual area covered is much greater.

THE STATE FIRE WARDEN'S REPORT.

Mr. F. W. RANE, *State Forester.*

SIR: — In compliance with your request, and in accord with the provisions of chapter 722, section 2, Acts of 1911, I beg to submit the following report of the work accomplished by this branch of the department this year: —

While we have experienced a very serious drouth during the summer and fall of 1914, and our number of fires exceeds by a large margin that of any former year in the history of the department, we have been able, by the efficient work of our men and the hearty co-operation of many residents of the Commonwealth, to hold our loss to a remarkably low figure. With a period of thirty-eight days, from September 9 to October 17, with only one-fourth of an inch of rainfall, and during this period a legal holiday, October 12, which was also the opening day of the hunting season, with 60,000 hunters and as many more pleasure seekers roaming through the woods from Cape Cod to the Berkshire Hills, it is not surprising that many dangerous fires occurred. On this date our reports show 166 fires reported, mostly confined to Middlesex, Worcester and the western counties. Of the above fires, 13 were dangerous, and burned over an area of nearly 8,000 acres. While the area burned was not all forested land, considerable timber was destroyed. Most of these fires would have been controlled at the start providing our observation system had been completed in this locality, but it is necessary that 7 more stations be established throughout the central and western part of the State in order to fully protect this area. On October 12 there were 166 fires, and for the week ending October 17, 384 fires were reported. Owing to the large number of fires at this time, His Excellency the Governor was obliged to declare a close season on game extending to October 17.

We have maintained the same arrangement of districts as in former years, viz., four districts, each under the supervision of a district forest warden; but owing to our construction work throughout the eastern part of the State being done entirely by the district men, they have been unable to devote as much time to organization work in their several towns as had been hoped. This difficulty will be overcome as our system becomes completed, and we are in hopes that another year will practically finish the construction work.

The amendment of the forest law relative to the appointment of town forest wardens, allowing such appointments to be made in January instead of in March and April, has facilitated the work of this department, as we are enabled to have our lists completed during February and in readiness for spring fires. I am still of the belief that much better results would be accomplished throughout the State if this department were to appoint these town forest wardens. We are handicapped in a number of towns by having inefficient wardens who do not have the faculty of handling men and who are not interested in the protection of the forests. I firmly believe that our district men can recommend to this department in the different towns throughout their districts men who have the interests of the Commonwealth at heart and who would make ideal forest wardens, — men who would co-operate with our observers, perfect a forest fire-fighting organization in their towns, and not only be the means of lessening the expense of extinguishing fires, but also materially reduce the damage.

Observation Stations.

We have had in operation this year 24 observation stations reporting 3,013 fires, as follows: —

Becket Mountain, Becket,	63
Blue Hill, Milton,	236
Bluff Head, Sharon,	203
Bonney Hill, Hanson,	68
Bournedale, Bourne,	54
Copecut Hill, Fall River,	33
Cran Pond Hill, Ashfield,	2
Fay Mountain, Westborough,	386
Grace Mountain, Warwick,	94
Hart Hill, Wakefield,	174
Harwich, Harwich,	35
Howland's Hill, Falmouth,	1
Lincoln Mountain, Pelham,	47
Massaemet Mountain, Shelburne Falls,	130
Middleborough, Middleborough,	133
Mt. Tom, Easthampton,	135
Morse Hill, Essex,	96
Reservoir Hill, Plymouth,	116
Richmond Hill, Dighton,	105
Robbins Hill, Chelmsford,	302
Shoot Flying Hill, Barnstable,	14
Steerage Rock, Brimfield,	90
Tower Mountain, Savoy,	11
Wachusett Mountain, Princeton,	485
Total,	3,013

Of the above stations five were new this year, four of which were placed in operation late in the season. Two substations, one on Prospect Hill in Petersham, and one on Little Mugget Hill in Charlton, it was not deemed advisable to use this season.

A new steel tower 40 feet high, with a 10 by 10 foot room at the top, has been erected on Shoot Flying Hill, Barnstable, to replace the old wooden structure that had been in use for nineteen years. The new tower is 10 feet higher than the former one, and gives an excellent view for a radius of 12 miles.

During the season an observation room for the Bournedale tower has been completed. A new 40-foot tower has been erected on Howland's Hill, Falmouth, which enables us to protect several other towns.

A new 60-foot steel tower has been erected on Copecut Hill in Fall River. This is located near the Watuppa Reservation and protects a large forested area in Fall River and adjoining towns. The city of Fall River, as well as the towns of Westport and Dartmouth, contributed very liberally toward the expense of erecting this tower.

An observation station has been established on Prospect Hill, Petersham, but no tower was erected. One mile of telephone line was constructed. This station protects the Harvard School holdings of several thousand acres.

A wooden tower, with 1 mile of telephone line, has been installed on Cran Pond Hill in Ashfield. This is one of several stations that are needed in western Massachusetts to protect the large forest areas in that portion of the State.

The observation towers have again demonstrated their value in the large number of fires reported and extinguished in their incipiency. The following comparative statement of forest fires during the year 1911 with those of 1914 is very interesting, the 1911 loss being before the present fire lookout system was established.

COMPARATIVE TABLE OF FIRES, 1911 AND 1914.

	Number of Fires.	Acreage burned.	Cost to extinguish.	Damage.	Average Acreage per Fire.	Average Damage per Fire.
1911, ...	2,536	99,693	$47,093	$537,749	39.31	$226 24
1914, ...	3,181	38,975	48,750	95,389	12.25	29 98

These figures are very significant. The period of drouth was more serious and considerably longer in 1914 than in 1911, thereby making the fire danger much greater. In studying this table you will note that we had 645 more fires in 1914 than in 1911, but that our damage was reduced nearly $450,000 in 1914. Again, the average damage per fire in 1911 was $226.24 as against $29.98 this year.

While we have had some large fires, they are not chargeable to the inefficiency of our observers or to their neglect of duty. I have in mind an instance where the observer called up the town forest warden, giving him the exact location of a fire which was just starting. The warden, being doubtful, telephoned two or three parties near the location of the fire and received the reply that they were unable to discover any fire. Two hours later he received a telephone call stating that the fire had then covered 50 acres. The outcome was that 500 acres were burned over.

We have had an unusually large number of visitors to the towers this year, and I believe that when pleasure-seeking automobilists become familiar with our roads leading to within a few minutes' walk, and in many cases directly to the towers, this number will be materially increased. Our towers are nearly all equipped with stairs, so that they are accessible to any one. We are always pleased to have the public visit them, not only because of the pleasure they may derive from the beautiful scenery for miles around, but also from an educational standpoint. Our observers are always very courteous and take pleasure in explaining our system, giving visitors a comprehensive idea of what the State is endeavoring to do to suppress our forest-fire evil.

Proposed Stations.

I am in hopes that during the coming year we shall have sufficient appropriation to install the following observation stations, thereby practically completing our system: —

Nobscot Hill, Framingham.
Great Meadow Hill, Rehoboth.
Miscoe Hill, Mendon.
Lair Hill, Tolland.
Holcomb Hill, Chester.
Berlin Mountain, Berlin, New York.
Yokun Seat (Pinnacle), Lenox.
Mt. Everett, Mount Washington.

The last three would be maintained jointly by Massachusetts, Vermont, New York, Connecticut and the Federal department.

Forest-fire Equipment.

Under an act of the Legislature, passed in the spring of 1910 and amended in 1914, appropriating $5,000 annually for forest-fire protection, towns with a valuation of $1,750,000 or less are entitled to 50 per cent. reimbursement on all forest fire-fighting equipment they desire to purchase not exceeding $500, no town being allowed an amount exceeding $250. All forest-fire equipment purchased under this act is approved by this department and placed under the supervision of the town forest warden, subject to inspection at all times by the State Fire Warden or the district forest wardens.

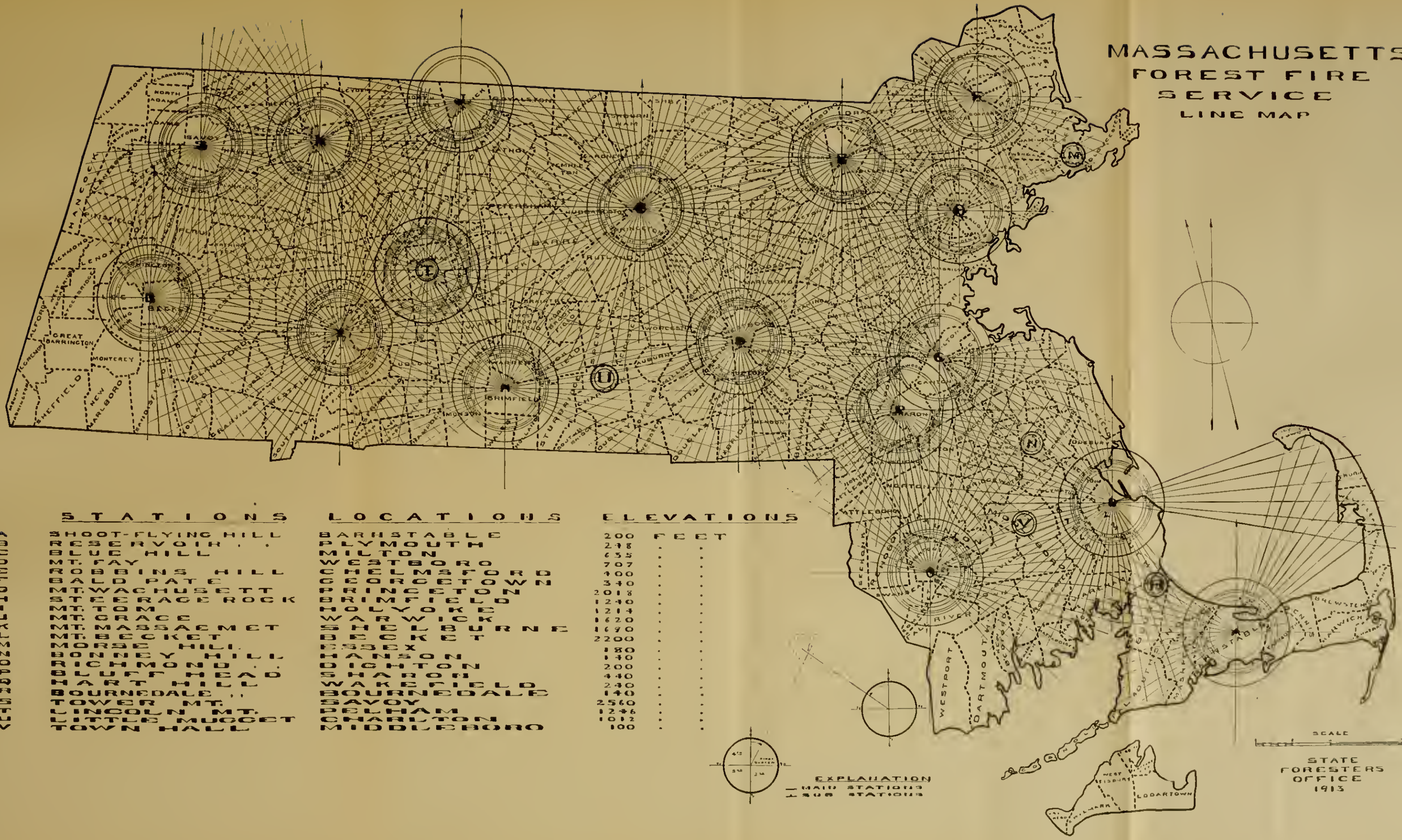
There are at the present time 165 towns entitled to reimbursement under the act. Of this number, 120 towns have expended a portion, and in some instances all, of their allotment, as is shown in our inventory of equipment on page 50. Nearly all the towns throughout the eastern part of the State that come under the act have taken advantage of it, but we still have many towns in the central and western portions of the State that have not. We limit the towns to the purchase of equipment that is suitable for forest-fire work, such as motor trucks, fire wagons, pumps, extinguishers, water cans, pails, shovels, brooms, etc. Owing to the financial condition of many of our smaller towns it has been extremely hard this year to get appropriations for purchasing forest-fire equipment. Our table on page 54 shows, however, that 50 towns have taken advantage of the act and have been reimbursed to the amount of $2,127.05.

Railroad Fires.

It is certainly very gratifying to note the marked improvement that has been made during the past three years by the railroads throughout the Commonwealth in endeavoring to lessen the number of forest fires

MASSACHUSETTS FOREST FIRE SERVICE

LINE MAP


WILLIAMSTOWN
NORTH ADAMS
ADAMS
SAVOY
BECKET
GREAT BARRINGTON
MONTEREY
SHEFFIELD
NEW MARLBORO
ATHOL
TEMPLETON
BARRE
RUTLAND
PRINCETON
WORCESTER
MARLBORO
WARREN
BRIMFIELD
MONSON
SHARON
ATTLEBORO
NORTON
WESTPORT
DARTMOUTH
BREWSTER
BARNSTABLE
WEST TISBURY
EDGARTOWN
MT
U
N
V
R
T
SCALE

STATIONS		LOCATIONS	ELEVATIONS
A	SHOOT-FLYING HILL	BARNSTABLE	200 FEET
B	RESERVOIR . .	PLYMOUTH	248 "
C	BLUE HILL	MILTON	635 "
D	MT. FAY	WESTBORO	707 "
E	ROBBINS HILL	CHELMSFORD	400 "
F	BALD PATE	GEORGETOWN	340 "
G	MT. WACHUSETT	PRINCETON	2018 "
H	STEERAGE ROCK	BRIMFIELD	1240 "
I	MT. TOM	HOLYOKE	1214 "
J	MT. GRACE	WARWICK	1620 "
K	MT. MASSAEMET	SHELBURNE	1690 "
L	MT. BECKET	BECKET	2200 "
M	MORSE HILL	ESSEX	180 "
N	BONNEY HILL	HANSON	140 "
O	RICHMOND . .	DIGHTON	200 "
P	BLUFF HEAD	SHARON	440 "
Q	HART HILL	WAKEFIELD	240 "
R	BOURNEDALE . .	BOURNEDALE	140 "
S	TOWER MT.	SAVOY	2560 "
T	LINCOLN MT.	PELHAM	1246 "
U	LITTLE MUGGET	CHARLTON	1012 "
V	TOWN HALL	MIDDLEBORO	100 "

EXPLANATION

— MAIN STATIONS

⊥ SUB STATIONS

STATE
FORESTERS
OFFICE
1913

caused by locomotives. For the past two years this department, in co-operation with the Public Service Commission, has maintained a system of inspection of spark arresters and ash pans at the different railroad terminals in the State, and the inspections made this year certainly show that extra precautions have been taken by the railroad officials to keep their ash pans and screens in perfect condition. While we have found defects, they have been mostly minor ones and have been promptly repaired. In nearly all instances the railroads have complied with the law relative to keeping the right of way free from all combustible material, and several miles of lands adjoining the right of way have been thinned out so that where this work has been done there is very little danger of fire making much headway in case it should start.

The reports show that the percentage of railroad fires has been reduced to 26 per cent. and the loss to $16,000, which is the lowest railroad fire damage of which we have any record. With over 2,000 locomotives in operation we must expect a certain percentage of fires from this source, but the efforts put forth by the railroads show that they can be reduced to a minimum, and I feel that due acknowledgment should be given to Mr. E. A. Ryder of the Boston & Maine, Mr. R. D. Smith of the Boston & Albany, Mr. Chas. B. Rood and Mr. G. W. Wildin of the New York, New Haven & Hartford for their hearty co-operation with this department. Our reports show that we have had 830 railroad fires, as follows: New York, New Haven & Hartford, 389; Boston & Albany, 128; Boston & Maine, 253; and Central Vermont, 60, burning over a combined area of 4,508 acres, with a damage of $16,649 and a cost to extinguish of $4,884.

The following information has been received from the Boston & Maine and Boston & Albany railroads relative to fire-prevention work done by them during the past year: —

Boston & Maine Railroad, Department of Fire Claims,
Boston, Mass., Dec. 21, 1914.

Mr. M. C. Hutchins, *State Fire Warden*, *Boston*, *Mass.*

Dear Sir: — In accordance with your request for information regarding the fire-prevention work done by this company during the past season, we beg to submit the following: —

Although there was a greal deal of snow last winter, which remained up to the middle or last of March, the high winds immediately following its departure made everything extremely dry, and conditions were favorable for fires. In April, May and June it was hot and dry, and there were many fires; in July and August there was considerable rain, and we had reports of only 98 fires on the whole system in July and 45 in August; but September, October and November were generally dry, — in fact, the weather was much like real summer days, and fires were numerous. There was a very noticeable increase in the number of reports of fires as soon as the hunting season opened, and it was most fortunate that His Excellency Governor Walsh was so quick to scent the danger and prompt in taking steps to relieve it. Comparing this season with the very bad season of 1913, they average about the same, although this season the fires supposed to have been set by sparks from locomotives have not shown as much damage, which we think is accounted for in a large measure by the prompt discovery and fighting of fires.

Since the 1st of last March we have secured 16 permissions from the owners of land adjacent to our property in Massachusetts to clear back a strip for say 100 feet from our right-of-way fence, and this work has been completed. We hope the new Massachusetts law which will take effect Jan. 1, 1915, requiring operators to clear back the brush for a distance of 40 feet from our right of way will be of great assistance in keeping down the fire hazard, as a similar law in New Hampshire, with the prescribed distance only 25 feet, has certainly produced good results, and when owners or operators have been clearing the slash we have in many cases persuaded them to remove it a greater distance than required by law.

In addition to the customary inspection which is made of the spark arrester and ash pan on all our locomotives, since March 1, 1914, we have requested special inspections made of 433 locomotives reported as setting fires, with the result that only 56 were found to have any defect, most of these being very slight. We mention this only to show that the matter of inspection of locomotives is receiving more than routine attention.

Last June we placed a "fire warning" card in all of our principal stations and terminals, believing it is absolutely necessary to keep *fire prevention* constantly before the eyes of the public. While it is difficult for any one to really know how much value there is in publicity, from remarks we have heard, and the many inquiries we have received from various people, about this subject we feel positive that it is beneficial; for instance, the superintendent of schools in Winchester, Mass., requested a supply of these cards so that the subject could be discussed with and placed before the school children in his town.

During the past season we have given special attention to improving the patrol service in dangerous sections on our system, and the result has been very gratifying to us.

During the past year much more effective co-operation has been attained with the towns in the matter of discovering and promptly fighting fires, and we are pleased to speak most highly of the faithful attention of the "lookout" men and the splendid work of the fire wardens. The bills from the towns for fighting fires are now rendered promptly after each fire, properly made out on the standard form, with explanation of the detail, which assists us in approving their payment. Practically every town with which we have had dealings has accepted the rate of 25 cents an hour for fighting fires; and all this co-operation and assistance is in a large measure the result of the splendid efforts on the part of your district chiefs.

Yours truly,

E. A. Ryder,
Commissioner.

Statement by the Boston & Albany Railroad (New York Central Railroad Company, Lessee).

The Boston & Albany Railroad, during the year 1914, reduced both the number and extent of the fires on its right of way and adjoining property, the number of fires reported being the smallest since 1908. The co-operation of the employees of the company and the fire wardens in the cities and towns through which the railroad runs contributed largely to this result. There have been no extensive forest fires along the line of the road during the present year.

All buildings have been equipped throughout with fire extinguishers of an approved type, hand grenades, fire buckets, with tubs filled with water and painted red and marked "For use in case of fire only." Regular periodical inspection of this equipment is made, and instructions are in effect that the fire buckets and tubs are not to be obstructed or used for any other purpose.

The use of wooden shingles has been discontinued altogether, and adjacent to the right of way all new roofs are now covered with either asbestos shingles, slate or tin. Fireproof paint has been used to a considerable extent in the interior of buildings.

Special zinc-lined receptacles have been provided outside of buildings where stoves are used, for taking care of ashes and cinders from the stoves.

Regular inspection is made underneath all wooden platforms, and all rubbish and paper refuse, etc., is removed.

Instructions are in effect that the right of way shall be carefully and completely burnt over at least twice a season, and oftener if necessary; and that such operations shall be carried on in co-operation with the local fire warden, and if necessary with owners of adjacent property. In some cases where there has been added risk, permission from owners of adjacent property has been obtained and railroad employees have done the burning. In places where the likelihood of fire is great, additional vigilance is used, and in some places patrols are placed. Section cars within the zones most subject to fires are all furnished with approved extinguishers, which are carried at all times on the car during the season fires are most likely to occur. On many occasions these have been found to be of great service.

All Boston & Albany locomotives are now equipped with a standard smoke-box arrangement with netting, which has been approved by the Public Service Commission of Massachusetts. The ash pans have wire screens to prevent live coals and cinders from being thrown out onto the tracks or right of way, and comply with the regulations of the Public Service Commission. All the locomotives operating on the Newton circuit are equipped with special patented exhaust pipes, which soften the exhaust and greatly reduce the number of sparks thrown from the stacks. On some of the locomotives the overflow pipes from the injectors have been relocated so as to discharge into the ash pans, thus cooling off the hot cinders in the pan. The smoke-box netting of all the locomotives is inspected at regular intervals and corrected before the locomotive is allowed to go into service. A number of locomotives used in switching in yards are equipped with fire extinguishers according to law and in compliance with orders of the Public Service Commission, and all car and locomotive shops are equipped with fire extinguishers and fire hose, with special men designated to man this hose in case of fire. Fire drills are also had at regular intervals.

Federal Co-operation.

The co-operative work carried on in the State in connection with the Federal department in protecting the watersheds of the Nashua, Chicopee, Miller, Thames, Blackstone, Hudson, Connecticut and Deerfield rivers has allowed us to better protect the central and western portions of the State than would have otherwise been possible. An allotment of $2,500 was made to us by the Federal department for this purpose, to be expended in payment of observers. This practically maintained our observation stations west of the east line of Worcester County. I am in hopes that as we extend our observation system in this portion of the State this allotment may be increased to meet, at least partially, the increased cost of maintenance.

Co-operative Forest Fire Conference.

Through an invitation extended by this department to the State foresters of the New England States, New York and Pennsylvania, and the Federal department, a co-operative forest fire conference was held in this city on Jan. 20, 21 and 22, 1914, at which the following program was carried out: —

January 20, Morning Session, 9 A.M.

Chairman, State Forester F. W. Rane.

The "Weeks Law," Co-operative Fire Protection and Federal Requirements in its Administration, Mr. J. G. Peters of the United States Forest Service.

Lookout System, Telephone Construction and Telephone Contracts, Mr. Wm. G. Howard, New York.

Afternoon Session, 1.30 P.M.

Chairman, Mr. W. O. Filley of Connecticut.

Interstate Co-operation in the Reporting of Forest Fires, Mr. F. W. Rane.

Co-operation with Rural Mail Carriers, Mr. Blaine S. Viles, Maine.

Forest Fire Patrol, and Co-operation with Private Owners, Mr. E. C. Hirst, New Hampshire.

January 21, Morning Session, 9 A.M.

Chairman, Mr. E. C. Hirst.

Publicity as a Valuable Adjunct in Forest Fire Prevention Work, Mr. Chas. P. Wilber, New Jersey.

Slash Disposal, Fire Lines and Trails, Mr. A. F. Hawes, Vermont.

Methods of handling Severe Forest Fires, Mr. Wm. G. Howard, New York.

General Discussion of Unassigned Topics.

Afternoon Session, 1.30 P.M.

Chairman, Mr. A. F. Hawes.

Railroad Fire Protection, Mr. W. O. Filley, Connecticut: —

- (*a*) Equipment of locomotives with suitable fire protective devices.
- (*b*) Methods of securing satisfactory inspection of railroad rights of way and provision for the removal of all inflammable material from the same.
- (*c*) Railroad fire lines.
- (*d*) The disposal of slash on privately owned lands adjacent to railroad rights of way or highways.

Representatives from the New York, New Haven & Hartford, Boston & Maine, Boston & Albany and New York Central & Hudson River, Central Vermont and Rutland railroads were in attendance during this discussion.

Reception at New American House, 5.30 P.M. Banquet, 6 P.M. Mr. F. W. Rane, Toastmaster.

Addresses by Mr. E. A. Ryder of the Boston & Maine Railroad, Mr. C. N. Woodward of the New York, New Haven & Hartford Railroad, Mr. J. H. Foster of the New Hampshire State College, Mr. Harris A. Reynolds, Secretary of the Massachusetts Forestry Association, Mr. A. F. Hawes, State Forester of Vermont, and others.

January 22, Morning Session, 9 A.M.

Mr. W. L. Larry of the Massachusetts Public Service Commission in charge.

Inspection of the different style spark arresters used by the Boston & Maine and New York, New Haven & Hartford railroads, including the Mudge-Slater and the Stearns spark arresters.

Afternoon Session.

Mr. M. C. Hutchins, Massachusetts State Fire Warden, in charge.

Inspection of observation tower and equipment, also modern forest-fire wagon, at South Hanson.

Among those present were Mr. Robert S. Conklin, Commissioner of Forestry, Harrisburg, Pa., Mr. Jesse B. Mowry, Commissioner of Forestry, Chepachet, R. I., Robert M. Ross, State Fire Warden, Burlington, Vt., Allen Chamberlain and Harris A. Reynolds representing the Massachusetts Forestry Association, as well as many representatives of woodland owners, who took part in the discussions. A very interesting and instructive meeting was enjoyed.

Forest Warden Conferences.

During the months of February and March this department held a series of forest warden conferences throughout the State. These were held at Pittsfield, Greenfield, Worcester, Fitchburg, Springfield, Haverhill, Middleborough and Boston. The object of the meetings was that employees of the department might get in closer touch with the town forest wardens and selectmen, and discuss with them the different methods of handling forest fires, the organizing of forest fire-fighting crews, the appointing of deputies located in the outlying portions of the different towns, and the importance of procuring suitable equipment for handling forest fires.

These meetings were very instructive and were attended by nearly all the forest wardens throughout the State, each one being free to discuss matters pertaining to his locality. Short talks were given by members of this department on the general outline of the system and work. Mr. E. A. Ryder of the Boston & Maine Railroad and Mr. Chas. B. Rood of the New York, New Haven & Hartford Railroad were in attendance, and explained fully what these railroads are endeavoring to do in order to lessen the expense caused by railroad fires.

A law was enacted this year relative to the disposal of slash and brush and is a forward step toward reducing our forest-fire hazard. While the law is not as broad and as far-reaching as I would desire, at the same time it will necessitate the removal of much dangerous slash accumulating along highways and railroad rights of way, and will protect areas adjoining land where wood and lumbering operations are being carried on.[1]

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[1] See "Agricultural Legislation of 1914," p. 334.

INVENTORY OF EQUIPMENT PURCHASED UNDER THE REIMBURSEMENT ACT.

Town.	Axes.	Cans.	Extinguishers.	Hoes.	Lanterns.	Mattocks.	Pails.	Pumps.	Rakes.	Shovels.	Wire Brooms.	Wagons.	Reimbursement.
Acushnet, . .	1	10	16	–	–	–	4	1	–	–	–	2[1], [3]	$250 00
Ashburnham, .	–	–	8	–	–	–	–	–	–	–	–	–	25 00
Ashby, . . .	–	–	36	–	–	–	2	2	–	6	–	–	115 70
Ashfield, . .	–	–	33	–	–	–	–	–	–	–	–	–	99 00
Ashland, . .	–	12	10	–	–	–	12	6	–	6	12	–	77 91
Auburn, . .	–	–	83	–	–	–	–	–	–	–	–	–	249 00
Avon, . . .	–	10	–	–	–	–	12	–	–	–	–	–	9 90
Becket, . . .	–	14	16	–	–	–	–	2	–	–	24	–	79 50
Bedford, . .	1	14	24	–	–	–	–	–	–	–	–	1[2]	249 67
Belchertown, .	–	–	40	–	–	–	–	1	–	–	–	1	175 87
Bellingham, . .	–	16	23	–	–	–	6	–	–	8	–	1[1]	122 92
Berkley, . .	–	36	24	–	–	–	–	–	–	–	–	–	162 00
Berlin, . . .	2	10	38	–	–	1	12	–	3	12	–	1[1]	241 45
Blandford, . .	–	1	16	–	–	–	–	–	–	–	–	–	59 80
Bolton, . . .	–	14	27	–	–	–	6	–	–	6	–	–	107 15
Boxborough, .	1	12	30	–	–	2	–	–	3	4	3	1[1]	182 80
Boxford, . .	–	–	16	–	–	–	–	–	–	–	–	–	45 60
Boylston, . .	–	–	66	–	–	–	24	–	–	28	–	–	243 61
Brimfield, . .	–	10	30	–	–	–	–	–	–	–	–	–	99 75
Burlington, . .	–	–	20	–	–	–	–	–	–	–	–	–	100 00
Carlisle, . .	2	15	19	–	2	–	6	–	1	6	–	1[2]	247 72
Charlton, . .	–	–	77	–	–	–	40	–	–	60	–	–	250 00
Chatham, . .	2	15	11	–	2	3	4	–	3	5	–	1[1]	152 98
Chester, . .	–	37	15	–	–	–	–	5	–	–	12	–	97 02
Chesterfield, .	–	–	25	–	–	–	–	–	–	–	–	–	75 00
Cummington, .	–	–	12	–	–	–	–	–	–	–	–	–	64 50
Dana, . . .	–	–	6	–	–	–	–	–	–	–	–	–	18 75
Dighton, . .	2	8	18	–	1	–	–	–	2	2	18	1[1]	117 79
Douglas, . .	–	25	50	–	–	–	–	–	–	–	–	–	175 00
Dunstable, . .	2	25	10	–	1	–	4	–	3	6	6	1[1]	106 14
East Longmeadow,	2	–	18	–	2	–	12	1	–	4	–	1[1]	153 96
Edgartown, . .	2	5	10	–	2	3	4	–	3	5	–	1[1]	152 17
Enfield, . .	–	20	–	–	–	–	–	–	–	–	–	–	1 50
Erving, . .	–	–	25	6	–	–	–	–	–	18	–	–	86 52
Essex, . . .	–	24	12	–	–	–	–	–	–	–	–	–	37 80

[1] One-horse. [2] Two-horse. [3] Motor truck.

INVENTORY OF EQUIPMENT PURCHASED UNDER THE REIMBURSEMENT ACT — *Continued.*

Town.	Axes.	Cans.	Extinguishers.	Hoes.	Lanterns.	Mattocks.	Pails.	Pumps.	Rakes.	Shovels.	Wire Brooms.	Wagons.	Reimbursement.
Florida,	–	–	8	–	–	–	–	–	–	–	–	–	$26 00
Freetown,	–	24	20	–	–	–	–	2	–	72	–	–	167 48
Georgetown,	–	30	54	–	–	–	–	–	6	12	–	–	194 08
Gill,	–	5	20	–	–	–	–	–	–	–	–	–	65 00
Goshen,	–	12	58	–	–	–	–	–	–	–	–	–	244 05
Granby,	–	12	12	–	–	–	–	–	–	–	–	–	39 90
Granville,	–	–	–	–	–	–	–	–	–	–	–	2[1]	130 00
Greenwich,	–	–	18	–	–	–	–	–	–	–	–	–	60 45
Groveland,	–	6	12	–	–	–	–	–	3	12	–	–	51 05
Hadley,	–	–	15	–	–	–	–	–	–	–	–	–	75 00
Halifax,	–	12	64	–	–	–	12	–	–	18	–	1[1]	241 91
Hampden,	–	–	12	–	–	–	–	–	–	–	–	–	39 00
Hanson,	–	6	24	–	–	–	6	–	–	5	–	2[1, 3]	250 00
Harvard,	2	7	29	–	2	3	–	–	3	12	–	1[2]	250 00
Harwich,	–	–	–	–	–	–	–	2	–	–	–	–	8 50
Holbrook,	–	12	10	–	–	–	–	–	–	–	–	–	69 00
Holland,	–	–	8	–	–	–	–	–	–	–	–	–	25 00
Hubbardston,	–	–	52	–	–	–	18	–	–	4	–	–	175 75
Lanesborough,	–	5	–	–	–	–	–	3	–	–	36	–	26 50
Leverett,	2	20	16	8	2	4	–	–	4	8	–	2[1]	160 17
Leyden,	8	10	4	9	–	–	–	–	4	4	–	–	22 35
Lunenburg,	2	36	10	–	2	3	4	–	3	29	–	1[1]	160 37
Lynnfield,	–	35	20	–	–	–	–	10	–	–	6	2[1]	249 95
Mashpee,	–	–	22	–	–	–	–	–	–	12	–	1[1]	124 80
Mendon,	–	24	21	–	–	–	–	–	–	–	30	1[1]	170 22
Merrimac,	–	–	15	–	–	–	–	–	–	–	–	–	75 00
Middleton,	–	–	16	–	–	–	–	–	–	–	–	–	49 50
Millis,	–	–	8	–	–	–	–	–	–	–	–	1[2]	242 00
New Braintree,	–	–	37	–	–	–	–	–	–	–	–	–	120 97
Newbury,	–	–	6	–	–	–	–	8	–	–	12	–	55 90
New Salem,	–	55	20	–	–	–	–	–	–	–	–	–	100 50
Norfolk,	–	–	18	–	–	–	–	–	–	–	–	–	99 00
North Reading,	–	–	38	–	–	–	–	–	–	–	–	1[1]	248 43
Northborough,	–	–	25	–	–	–	–	–	–	–	–	–	102 37

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[1] One-horse. [2] Two-horse. [3] Motor truck.

INVENTORY OF EQUIPMENT PURCHASED UNDER THE REIMBURSEMENT ACT — *Continued.*

TOWN.	Axes.	Cans.	Extinguishers.	Hoes.	Lanterns.	Mattocks.	Pails.	Pumps.	Rakes.	Shovels.	Wire Brooms.	Wagons.	Reimbursement.
Norwell,	6	–	32	–	–	–	12	–	–	12	–	1[1]	$250 00
Oakham,	–	12	30	–	1	1	6	–	3	3	–	1[1]	222 97
Otis,	–	5	10	–	–	–	–	–	–	–	–	–	62 50
Paxton,	3	–	28	12	–	–	–	–	–	6	–	–	105 87
Pelham,	–	–	19	–	–	–	–	5	–	–	–	–	84 12
Pembroke,	–	–	31	–	–	–	60	–	–	–	–	1[2]	250 00
Petersham,	2	10	36	–	2	3	4	-	3	5	–	1[1]	248 05
Phillipston,	–	36	38	–	–	–	–	1	–	–	–	–	130 15
Plainville,	2	10	22	–	2	3	4	–	3	5	18	1[1]	225 00
Plympton,	–	–	–	–	–	–	–	12	–	–	–	–	20 93
Prescott,	–	–	10	–	–	–	–	–	–	–	–	–	48 16
Princeton,	–	32	80	–	–	–	–	–	–	–	–	–	249 20
Raynham,	3	46	30	–	6	3	12	–	9	15	–	3[1]	222 23
Rehoboth,	–	10	48	–	–	–	–	–	–	–	–	1[1]	250 00
Richmond,	–	15	25	–	–	–	4	–	–	–	–	–	86 20
Rochester,	–	24	60	–	–	–	–	–	–	30	–	–	205 37
Royalston,	3	10	22	30	2	2	12	–	–	42	–	1[1]	145 10
Russell,	–	7	39	–	–	–	–	–	–	–	–	1[1]	220 25
Rutland,	–	12	18	–	–	–	6	–	–	–	–	1[3]	250 00
Salisbury,	3	–	9	–	6	–	24	–	–	6	–	–	38 87
Sandwich,	22	12	36	–	–	2	–	–	–	24	–	1[1]	245 60
Shelburne,	–	–	50	–	–	–	–	–	12	6	–	1[1]	186 87
Shirley,	–	48	36	–	–	–	–	–	–	–	–	–	139 50
Shutesbury,	–	16	25	–	–	–	–	–	–	–	–	–	87 50
Southwick,	–	12	26	–	–	–	–	–	–	–	–	1[1]	101 50
Sterling,	–	–	25	–	–	–	–	–	–	–	18	1[2]	241 12
Stow,	–	–	42	–	–	–	–	–	–	18	–	–	131 31
Sturbridge,	–	11	35	–	–	–	–	–	–	–	–	–	116 45
Sudbury,	–	–	40	–	–	–	–	–	–	–	–	–	250 00
Sutton,	–	50	50	24	–	–	–	–	32	24	–	–	188 46
Tewksbury,	2	–	24	–	2	–	–	–	–	30	–	1[1]	174 00
Tolland,	–	–	–	–	–	–	–	4	–	–	4	–	18 26
Townsend,	–	–	46	–	–	–	–	–	–	–	–	–	250 00
Tyngsborough,	–	220	20	–	–	–	–	54	12	24	36	–	250 00

[1] One-horse. [2] Two-horse. [3] Motor truck.

INVENTORY OF EQUIPMENT PURCHASED UNDER THE REIMBURSEMENT ACT — *Concluded.*

Town.	Axes.	Cans.	Extinguishers.	Hoes.	Lanterns.	Mattocks.	Pails.	Pumps.	Rakes.	Shovels.	Wire Brooms.	Wagons.	Reimbursement.
Tyringham, . .	2	10	10	–	2	–	10	–	2	3	–	1[2]	$112 30
Upton, . . .	–	–	30	–	–	–	–	–	–	–	12	1[1]	235 28
Wales, . . .	2	–	40	–	2	2	–	–	–	–	–	1[1]	236 77
Warwick, . .	–	6	10	–	–	–	–	–	–	–	–	1[1]	154 35
Washington, . .	–	–	10	3	–	–	6	–	–	8	–	1[1]	86 92
Wendell, . .	–	38	27	–	2	–	12	–	–	18	–	1[1]	163 24
West Boylston, .	–	–	107	–	–	–	–	–	–	–	–	–	250 00
West Bridgewater,	–	–	20	–	–	–	–	–	–	–	–	1[1]	200 12
West Brookfield, .	–	12	37	–	–	–	–	–	–	–	–	–	121 75
West Newbury, .	–	8	13	–	–	–	–	–	–	–	–	–	68 75
Westhampton, .	–	–	16	–	–	–	–	–	–	–	–	–	48 00
Westminster, .	–	77	48	24	–	–	24	–	–	24	–	–	244 09
Wilbraham, . .	–	27	32	–	–	–	23	–	12	6	–	–	118 38
Wilmington, . .	–	12	40	–	1	–	–	18	–	34	–	–	187 38
Windsor, . .	–	–	40	–	–	–	–	–	–	–	–	–	200 00
Worthington, .	2	15	10	–	–	3	–	–	–	5	–	1[1]	86 01
Wrentham, . .	–	12	30	–	–	4	–	–	–	–	–	1[1]	250 00
Totals, . .	83	1,484	3,143	116	44	42	407	137	129	712	247	54	$17,012 56

[1] One-horse.

[2] Two-horse.

TOWNS RECEIVING FIRE-EQUIPMENT REIMBURSEMENT DURING YEAR 1914.

Acushnet,	$106 78
Ashby,	81 20
Ashland,	60
Becket,	51 25
Belchertown,	4 25
Bellingham,	9 75
Berkley,	18 00
Bolton,	48 75
Boxborough,	2 34
Boylston,	167 41
Charlton,	28 63
Chester,	97 02
Cummington,	64 50
Dighton,	9 12
East Longmeadow,	4 25
Edgartown,	152 17
Enfield,	1 50
Essex,	37 80
Florida,	26 00
Georgetown,	59 25
Goshen,	122 32
Granby,	90
Hampden,	39 00
Harvard,	48 48
Harwich,	8 50
Holland,	25 00
Lanesborough,	$26 50
Leyden,	22 35
Lunenburg,	11 09
Lynnfield,	3 70
Mashpee,	50 00
Mendon,	80 22
New Braintree,	44 10
Newbury,	37 75
Norwell,	6 13
Oakham,	32 12
Otis,	2 50
Pelham,	7 50
Petersham,	45 50
Phillipston,	81 50
Plainville,	41 50
Southwick,	19 50
Tolland,	18 26
Tyngsborough,	60 20
Washington,	66 92
Wendell,	128 17
West Newbury,	35 00
Westminster,	1 87
Windsor,	50 00
Wrentham,	39 90
Total,	$2,127 05

FOREST FIRES OF 1914.

MONTHS.	Number.	Acres.	Cost to extinguish.	Damage.
1913.				
December,	2	19	$85 71	$175 00
1914.				
January,	2	16	25 90	15 00
February,	1	1	1 80	10 00
March,	67	99	91 91	15 00
April,	857	6,929	5,768 22	17,554 00
May,	516	6,557	6,077 67	19,383 00
June,	298	2,258	4,699 64	6,144 00
July,	65	231	755 92	1,240 00
August,	41	827	460 96	518 00
September,	302	3,348	6,115 64	8,609 00
October,	821	17,412	22,079 41	38,141 00
November,	209	1,278	2,587 47	3,585 00
Totals,	3,181	38,975	$48,750 25	$95,389 00

TYPES OF LAND BURNED OVER (ACRES).

Timber,	3,001
Second growth,	9,016
Second growth, not merchantable,	7,943
Brush,	11,645
Grass,	2,510
Not classified,	4,860
Total,	38,975

TYPES OF CLASSIFIED DAMAGES.

Standing trees,	$50,697
Lumber, logs and cordwood,	14,427
Buildings, bogs,	3,530
Bridges, fences,	331
Not classified,	26,404
Total,	$95,389

COMPARATIVE DAMAGES BY FOREST FIRES FOR THE PAST FIVE YEARS.

YEAR.	Number of Fires.	Acreage burned.	Cost to extinguish.	Damage.	Average Acreage per Fire.	Average Damage per Fire.
1910,	1,385	42,221	$23,475	$205,383	30.46	$148 29
1911,	2,536	99,693	47,093	537,749	39.31	226 24
1912,	1,851	22,072	20,219	80,834	11.92	43 67
1913,	2,688	53,826	35,456	178,357	20.02	66 35
1914,	3,181	38,975	48,750	95,389	12.25	29 98

CLASSIFIED CAUSES OF FOREST FIRES FOR THE PAST THREE YEARS.

CAUSES.	1912.		1913.		1914.	
	Number.	Per Cent.	Number.	Per Cent.	Number.	Per Cent.
Unknown,	649	35.1	650	24.2	1,174	37.0
Railroad,	640	34.6	913	34.0	830	26.0
Burning brush,	93	5.0	148	5.5	196	6.2
Hunters and smokers,	223	12.0	386	14.3	520	16.4
Steam sawmills,	8	.4	6	.2	3	.1
Children,	79	4.3	109	4.1	140	4.4
Miscellaneous,	159	8.6	476	17.7	318	9.9
Totals,	1,851	100.0	2,688	100.0	3,181	100.0

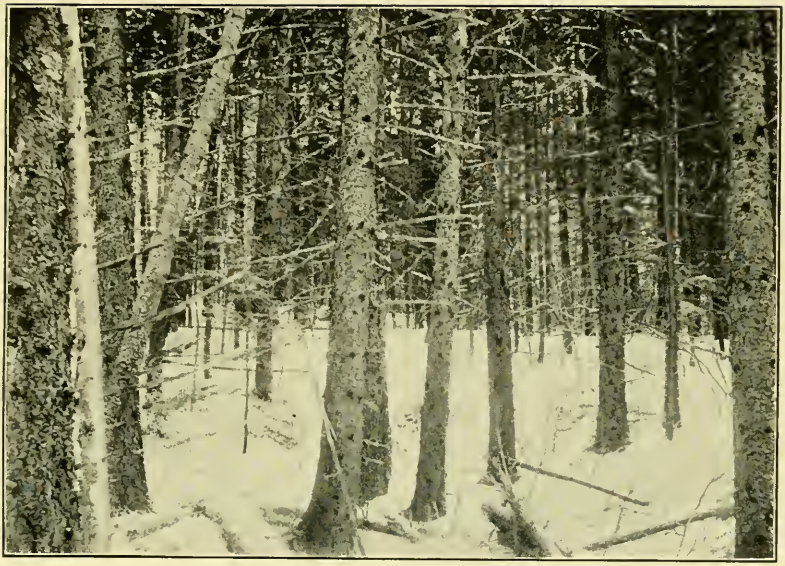
PRECIPITATION IN INCHES FOR THE YEARS 1911, 1912, 1913, AND 1914, WITH DECEMBER OF PREVIOUS YEAR.

MONTHS.	1911.	1912.	1913.	1914.	Normal.
December,	3.24	2.59	5.73	3.66	3.74
January,	3.07	3.87	3.21	4.30	4.12
February,	3.20	2.24	3.77	3.52	3.97
March,	3.27	5.26	5.32	4.20	4.34
April,	2.86	4.05	4.73	5.51	3.46
May,	.89	4.03	2.85	2.95	3.37
June,	4.76	.53	3.20	1.75	3.07
July,	4.55	4.16	2.00	3.38	3.65
August,	6.70	3.85	3.30	4.59	3.70
September,	3.36	1.71	2.77	.45	4.36
October,	3.01	1.52	7.62	2.03	4 13
November,	5.71	3.45	2.70	3.06	3.96
Totals,	44.62	37.26	47.20	39.40	45.87

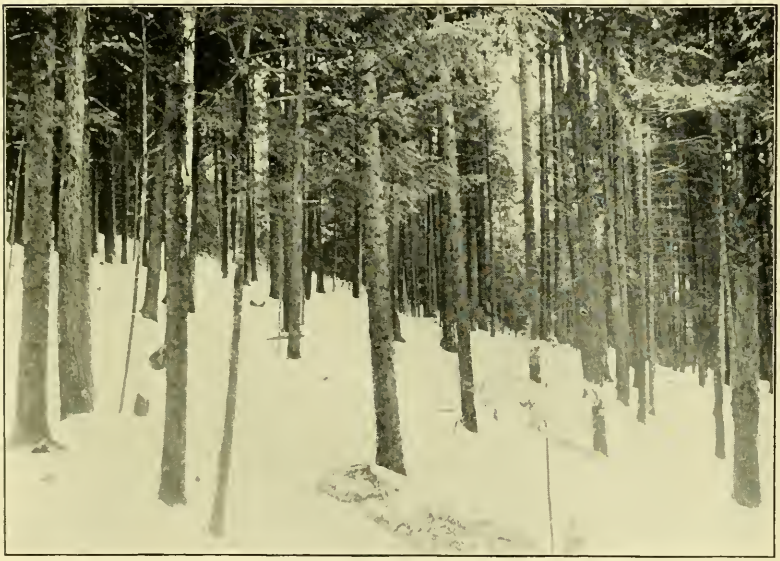
Our comparative tables on page 529 are very interesting, showing comparative fire losses for the past five years, comparative causes for the past three years, the number of forest fires by months, and the rainfall by months during the past year. Nearly 2,000 of our fires, classed as "unknown," "hunters" and "children," can be attributed to carelessness. It is certainly unfortunate in this enlightened age that pleasure seekers who are allowed the free use of the thousands of acres of forested area in the State will not use at least a little precaution when traveling through the woods, and not throw down lighted matches, cigarette stubs and cigar butts. We have had many prosecutions and convictions for violations of the fire laws, but it is almost impossible to convict the person who is traveling through the woods alone, as while we are satisfied in our own mind that he is the cause of the fire we have no evidence whatever that will convict him.

The permit law has been enforced quite generally throughout the State and is giving general satisfaction. Over 20,000 permits have been issued. While a few towns have not accepted this act I am in hopes that legislation may be enacted bringing all towns under its provisions.

Twelve thousand copies of the following fire notice, quoting extracts from the fire laws, have been posted throughout the forested area of the State: —



Spruce woodland, Cummington, Massachusetts, before thinning.



Light thinning in spruce woodland, Cummington, Massachusetts.

FOREST FIRES.

Your help is absolutely necessary if we are to prevent woodland fires. Do not throw down lighted matches, cigars, or cigarettes. Notify the nearest Forest Warden or Deputy in case of fire, and get busy yourself.

Good Citizens will be Cautious.

Others are hereby

WARNED

Setting fire to growing wood or timber of another.

Punishable by a fine of not more than $100 or by imprisonment for not more than six months. R. L. 208, Sec. 7.

Letting Fire Escape.

Negligently allowing fire to escape from your own land to adjoining land. Punishable by a fine of not more than $250, also liable for damages. R. L. 208, Sec. 8 and 9.

Permit necessary.

A permit must be procured from the Town Forest Warden for all fires in the open air between March 1 and December 1, except as provided in Sec. 1, Chap. 244, Acts of 1911. Penalty for violation, not more than $100 fine or imprisonment for not more than one month, or both such fine and imprisonment.

Penalty for Refusing Aid.

Any person between the ages of 18 and 50 years who refuses, without good cause, to assist the Forest Warden or his Deputies in the fighting of forest fires is liable to a fine of not less than $5 or more than $100. R. L. 32, Sec. 21; 1907, 475, Sec. 3.

Auto Parties.

Picnic Parties.

Hunters and Campers.

All persons visiting the forests will be held responsible for any damage they may cause.

F. W. RANE, State Forester,
______________Forest Warden. 6 Beacon St., Boston, Mass.

Posted by authority of Acts of 1907, Chap. 475, Sec. 2.

We have experienced considerable trouble with fires just over the town line this year. While we have made improvement along this line during the past three years we still have town officials who refuse to go into an adjoining town and extinguish a small fire, preferring to let it burn up to the line and then endeavor to extinguish it. I feel that our district wardens will in time overcome this jealousy between towns, so that we shall not then have these serious town line fires.

The power sprayers in use by many towns in the suppression of the gypsy and brown-tail moths have demonstrated their value at forest fires, possibly more along the North Shore than in any other portion of the State. During the months of September and October one was located at Beverly, one at Essex and one at Manchester. These were at the disposal of the forest wardens in these towns, and were brought into use at several fires. At a turf fire in Beverly two of them were in use for several days and did very effective work.

As our appropriation for forest-fire protective work is only $23,000, we have not been able to do as much construction work as we had desired to, but we have made it a point to erect substantial, permanent observation towers in each instance. These towers are all set on cement abutments which go below frost line, and all that is now required, that they may last for years, is painting once in three years. Nine of them have been painted this year.

We are asking for an increase of $7,000 in our appropriation this year, making a total of $30,000, which is absolutely necessary if we are to complete our construction work and maintain the present forest-fire policy. It is important that each of the four district wardens be furnished with a suitable truck properly equipped with fire-fighting apparatus, which may be held in readiness for use in case of emergencies. This would enable them to take on ten or more trained fire fighters and go to any serious fire. The above appropriation would allow the purchasing of at least two this year. The importance of such a truck was demonstrated at a fire on Sugar Loaf Mountain, New Ashford, which, after burning thirty-six hours, had assumed such proportions that it was practically beyond control. Owing to the serious fires burning west of the Connecticut River we had shipped to our district forest warden a supply of equipment for his use. This equipment, consisting of pumps, extinguishers, etc., was loaded on an automobile at 10 o'clock at night, and a 40-mile run was made to New Ashford, the district man arriving there about 2 o'clock in the morning. At 7 o'clock that morning 30 men were at work with the equipment on the fire, and before night the fire was under absolute control. This is but one case in many where the town had absolutely no equipment, and without a doubt this fire would have burned over a large area of the Greylock Reservation if assistance had not arrived at that time. This shows the importance of having equipment, with ways and means of getting to disastrous fires. While many of our towns have sufficient equipment for handling ordinary fires, it is an impossibility for them to cope with large ones. It therefore seems necessary, if we are to lessen the damage caused by our large fires, that our four district men be provided with suitable apparatus and means of getting it to a fire if the efficiency of their service is to be increased to a maximum.

In conclusion, I desire to express my appreciation of the loyal and hearty co-operation of all employees in this branch of the service.

Respectfully submitted,

M. C. Hutchins,
State Fire Warden.

Chestnut Bark Disease.

This disease, which was mentioned quite fully in last year's report, still continues to spread throughout the State, and at the present time is to be found to a greater or less degree in nearly all places where chestnut is growing. Regardless of the fact that both government and State men have given much time and effort to combat this very virulent tree disease, little has been learned during the past year that would tend to solve the problem of eliminating the disease without eliminating the chestnut trees on an extensive scale. Mr. Roy G. Pierce, the expert on chestnut blight who was connected with this office until July 1, 1914, covered the State quite thoroughly, making examinations, giving advice and lectures, and disseminating knowledge generally in regard to the disease and its workings, so that most woodland owners have at present a very fair idea of what the disease is like.

Clean cutting of all infected specimens is recommended where the disease occurs in woodland areas, and a certain amount of spread can be checked if the trees infected are cut when the cankers first appear rather than after they have girdled and killed the trees completely.

State Highway Planting.

At the request of Mr. Pillsbury, division engineer of the Highway Commission, we undertook a piece of work on a line which we have never undertaken extensively before, namely, setting out trees on the highway. After looking over several possible situations it was decided to do the planting on the State road between Ipswich and Newburyport. Eight hundred trees were set out in all, on a stretch of road 10 miles in length, at a cost, including the trees, of about $900. The following species and number of trees were planted: Norway maples, 400; white ash, 250; pin oak, 50; linden, 50; oriental plane, 50. Three hundred of the trees were staked, but guards were not put on them, as they stand on a road in the country, and few of them are near houses. The cost analyses are approximately as follows: —

	Per Tree.	Total.
Cost of trees,	$0 45	$356 50
Labor of planting,	40	318 00
Transportation,	10	80 00
Staking materials (300 trees),	10	32 00
Supervision,	04	30 00
	$1 09	$816 50

Municipal Forests.

It is believed that the time is ripe for many of our Massachusetts towns and cities to make a beginning in establishing a municipal forest. Already a few towns and cities have made a start in the right direction by planting the areas about their source of water supply, but why stop with this when there are in most instances available cheap lands that either already belong to the town or city or can be purchased at a low price. The great good to come from such an enterprise as this can only be appreciated when we take into account the experiences of the municipal forest propaganda of the old world. They have succeeded and our chances for success are even greater. If this office can be of any service to any city or town in establishing a municipal forest, we certainly shall consider it a pleasure to serve you. The Massachusetts Forestry Association of 4 Joy Street, Boston, is sending out some very interesting information on establishing municipal forests, and is also offering prizes to cities and towns which make the best showing.

SPECIAL CO-OPERATIVE MOTH WORK.

During the past season the general co-operative work, similar in many ways to that carried on heretofore with the North Shore people, has been executed in several places. The North Shore work is so well in hand, we are happy to report, that the expenditure has been greatly reduced the past season, and we hope to see still further curtailment the coming year, with equally good results.

The town of Dover entered into similar co-operative work over a year ago, and at present the results are extremely satisfactory. It was simply a case of doing the work properly and in time.

Some very effective work has been done in co-operation with those owning cottages about Lake Boon, and at present several undertakings are under way which are being entirely financed by individuals, corporations and municipalities.

MOTH AND FOREST SURVEY OF WINCHENDON.

As was slightly alluded to in last year's report, relative to making the town of Winchendon a "Black Forest" town, co-operative plans were agreed upon with Dr. L. O. Howard, representing the United States Department of Agriculture, and Mr. Ralph Zon of the United States Forest Service, whereby a thorough survey of the town was made. This report was submitted and explained to the townspeople at a public meeting called by the selectmen recently. A committee of three citizens was appointed at this meeting to confer with the State and government authorities for further consideration and recommendations.

The goal aimed at is to remove all trees that are the natural food plants of the gypsy and brown-tail moths. This logically carried out will give way to a large acreage of evergreen growth, particularly of white pine and spruce, which are of greater ultimate value. Already the town is well stocked with pine, and it is believed that an experiment on such a large scale — 29,000 acres — will be of great value not only to the town itself, but to the State and, in fact, to New England.

It is to be hoped that something definite can be undertaken, as the experiment will be valuable not only in eliminating future moth troubles, but in establishing a coniferous forest on an extensive scale, which economically and æsthetically would prove of great interest.

Moth Work in Boston.

When the moth-suppression work was placed under the supervision of the State Forester in 1909 the city of Boston was one of the worst infested districts in the State. The city up to that time had not attempted the work of suppression on a scale sufficient to make any permanent impression upon the insects, and the State had taken the attitude that the funds were not sufficient to be able to compel the city to do what the law requires. With these conditions, it inevitably followed that the trees were stripped bare of their leaves in various sections, and a great many trees died that might have been saved.

The following year, in 1910, this department began a systematic campaign of co-operative work with the city, and that work has progressed until at the present time we are happy to announce that the Boston trees are being as well cared for as any, and that hereafter the State's financial assistance will be relatively small if any. During the past five years the reimbursement from the State to Boston has been $82,000, and the city has also been at a very heavy expense. Now that the city superintendent, Mr. Wm. F. Long, has the work well in hand with modern spraying equipment, and a corps of trained men, this work should henceforth be kept up to its present standard at relatively small expense. It certainly would be suicidal to allow any indifference to creep in that would tend to lessen this work in Boston in the future. Trees are certainly one of Boston's greatest assets, and now that the conditions are so favorable, it is to be hoped that all Bostonians will uphold the work of Mr. John H. Dillon, chairman, Park and Recreation Department, and Mr. Wm. F. Long, the moth superintendent.

It is with pleasure that I publish the following report of Mr. Long, which points out more in detail Boston's present condition: —

DEC. 19, 1914.

DEAR SIR: — In response to your request for a report of the state of the gypsy and brown-tail moth infestations in the city of Boston, including Hyde Park, I would say that up to the present date conditions have been improved about 80 per cent. since we first commenced the suppression work. During each of the last two years we have been able to cover entire city and have had no defoliation. In the past year, particularly, we have made such good headway that we are considering the advisability of doing away with winter destruction and depending entirely upon the spraying treatment.

The woodland conditions of Boston are very good — infestations by gypsy moths very light, brown-tail moths, hardly any.

Hyde Park, which was so badly infested, is in excellent condition at the present time; so, also, are the woodlands of Dorchester and West Roxbury. Charlestown has no gypsy infestations and a very light brown-tail moth annoyance. East Boston has practically no moth troubles, Boston proper has a very light brown-tail infestation. South Boston has light quantity brown-tail but no gypsy disturbance. Conditions in Roxbury are similar to those prevailing in South Boston. Brighton has very light infestations of both gypsy and brown-tail moths. Jamaica Plain and Forest Hills sections have very light gypsy moth infestations. Dorchester has a light general infestation of gypsy, but very few of brown-tail moths.

A section of our parkway has a bad infestation of gypsy moths, but it can be handled easily. It seems as if all the caterpillars in the neighborhood selected this particular season.

During this past year we have been able to do considerable tree work, cutting out, cementing cavities, etc. The cement work was done principally in the East Boston section, but the removal and pruning was done liberally all over the city, also the roadside work.

Very truly yours,

WILLIAM F. LONG,
Foreman.

MOTH WORK IN BROOKLINE.

The town of Brookline has always been ready and willing, not only to co-operate in the moth-suppression work, but has always paid for all expenditures made in the town, although the town could have come under the reimbursement head. Both the moth superintendent, Mr. E. B. Dane, and the deputy, Mr. Daniel G. Lacy, have put the proper spirit into the work, and they have had a large territory to cover. It is believed that the following report of the work in this town will be of interest: —

BROOKLINE, MASS., Dec. 18, 1914.

DEAR SIR: — The following is a report of the condition of the town of Brookline relative to the gypsy and brown-tail moth situation. This past year the sum of $21,000 was appropriated by the town for insect work on the roadside trees and for private property.

Last winter we had a serious infestation of brown-tail moths, but from January to the middle of March we covered the town and removed the nests. The gypsy moth situation last winter was rather a scattered infestation. This past summer all the roadside trees in the town, about 65 miles in all, were carefully sprayed, and private property which was infested. A recent examination shows us more egg clusters of the gypsy moths in isolated cases than last year, but on the whole the situation is improved.

During the coming winter the entire town, including both roadside and all private property and woodland areas, will be carefully creosoted, and sprayed next spring.

We have very few brown-tail moths this year, and so far in our winter work, covering a period of five weeks, we have not found more than 100 nests of this insect. Last spring we had a considerable number of both varieties of the tent caterpillars, but prompt spraying remedied this condition.

In our recommendation to the town for the ensuing year the amount to be asked for will be larger than this past year, owing to the increase in wages paid, and acceptance by the town of the act giving the employees two weeks' vacation.

The moth situation in Brookline is well under control, as will be shown by the fact that the past two years we did not receive a single complaint on the defoliation of any tree in the town.

Respectfully submitted,

DANIEL G. LACY,
Superintendent.

MOTH FIELD DAY IN LINCOLN.

On July 7 a field day was held in Lincoln on the estate of Gen. Charles Francis Adams. This splendid estate comprises upwards of 600 acres, a large portion of which is covered with forest growth. This estate afforded one of the best opportunities to demonstrate moth-suppression work, as it contains a great variety of conditions. One of the finest so-called primeval growths of white pine is found here, while on other sections of the estate some magnificent specimens of oak and chestnuts can be seen. Mr. Adams has been reforesting and underplanting, as well as thinning and carrying on general forestry management, for several years.

Before the moths began to be destructive in Lincoln Mr. Adams conferred with the State Forester, and co-operative work was undertaken. He has a modern spraying equipment, and was able, through modern methods, to retain the foliage on his trees while adjoining properties have been in most cases stripped.

In order to facilitate matters, and call attention to the varying methods and conditions, placards were posted at various places over the estate, and a printed program explained each.

The State Forester wishes here to acknowledge the splendid interest that Mr. Adams has shown in this work, and to thank him in behalf of the Commonwealth for his hospitality on this occasion, as even the delicious luncheon for all attending was furnished by him.

Protecting and increasing Birds.

There is an increasing interest on the part of our people in doing what we can to encourage the bird life of our State, and this is commendable. Trees and birds are closely associated in the minds of all naturalists. State and national laws are being enacted to regulate wild life generally, and none are more interested in this work than foresters.

The birds are the guardians of our forest and shade trees and the orchards of the farmer. They are eternally waging a relentless warfare upon the insect hosts that prey upon the foliage, fruit and even the trunks and branches of the trees. In return for this safeguarding the trees themselves offer their hospitable branches as nesting sites for the birds, and stretch over them a canopy of green as a shelter from the oppressive rays of the sun and as a protection against the downpour of rain.

Some species of birds do not build nests among the branches, but excavate holes in the decayed trunks and branches of trees, and still others, not able to excavate homes for themselves, use these vacated apartments of the woodpecker family, and also the nesting boxes offered by their human friends. All of the birds having this nesting habit are of the most beneficial species, from the fact that their food is composed largely of insects, and we should in every possible manner encourage their numbers to increase.

Dead trees and decayed branches are a menace to the health of the forest, and are removed by the forester, who at the same time unwittingly destroys the future nesting site of a woodpecker. In order to provide nesting places, and at the same time promote the welfare of the forest by eliminating these plague spots of beetle and fungus, we must place in open spots, and along the borders of the woods, nesting boxes.

It is the purpose of the State Forester to interest woodland owners and others in building bird houses, or purchasing them from reliable dealers, and seeing that all localities take some part in this fascinating work. Mr. Bradford A. Scudder, secretary of the Massachusetts Fish and Game Protective Association, gives us the proper dimensions and descriptions necessary to build various kinds of bird boxes. Mr. Scudder and his association are very active in the work of caring for birds, having distributed tons of food for them in winter and offering for sale at small cost bird boxes of all kinds, etc.; hence the data which follow are reliable: —

The proper inside dimensions for nesting boxes for the following species are as follows: —

Bluebird. — Depth of box, 10 inches; floor, 5 by 5 inches; entrance, 1½ inches; lower edge of entrance, 7 inches above the floor.

Chickadee. — Depth of box, 10 inches; floor, 4 by 4 inches; entrance, 1¼ inches; lower edge of entrance, 7 inches above the floor.

Flicker. — Depth of box, 20 inches; floor, 6 by 6 inches; entrance, 2½ inches in diameter; lower edge of entrance, 16 inches above the floor.

Tree Swallow. — Depth of box, 7 inches; floor, 5 by 5 inches; entrance 1½ inches in diameter; lower edge of entrance, 4 inches above the floor.

The four species enumerated above are the ones most likely to occupy the nesting boxes, for they are found in large numbers throughout Massachusetts. The white-breasted nuthatch and the house wren are not as abundant as the birds just mentioned, but nevertheless each of these should be offered a home. The bluebird box will suffice for the nuthatch, and that of the chickadee for the wren.

Pine lumber seven-eighths of an inch in thickness, planed on one side only, is good material to use in the construction of these boxes. The rough side of the board should form the inside of the box. Stain the outside, only, a neutral tint of brown or gray. The entrance hole in each instance is circular, and should be cut with an extension bit, which is easily set for the varying size of entrance. Cut the entrance on an upward slant, rather than at direct right angle with the surface. This prevents the rain from driving in, and also simulates the doorway of the woodpecker architect, whose work we are copying. The roof should project an inch and a half in front, but be flush with the sides and back. The top should be removable, so that at the end of the season, after the departure of the birds, the box may be cleaned and any egg clusters of moths that are sometimes deposited there destroyed.

Each nesting box should have a layer of coarse, dry sawdust to the depth of 2 inches placed in the bottom. This is an important detail and should not be overlooked, especially in the box designed for the flicker.

Nesting boxes may be fastened to the trunk of a tree, or one of its large branches, care being taken that no intervening branches will prevent an easy ingress and exit by the occupants of the box. About the borders of fenced land boxes may be fastened to the tops of light poles, 12 feet in length, and these poles may then be fastened to posts in the fence, using lag screws or heavy wire spikes for the purpose. Tree swallows and bluebirds will tenant these boxes and gather their food from the insect hosts of field and orchard.

Do not place the boxes too near one another. Birds of the same species are apt to dispute ownership, so let a space of at least 200 feet intervene between the boxes.

Bird boxes should be placed at a height of not less than 8 or more than 20 feet above the ground. Boxes for the chickadee and house wren may be placed at the first-mentioned height, but for all others a height of at least 15 feet is better.

Bird boxes should have the entrance face the south or southwest, thus preventing the beating in of rain during violent, cold, northeasterly storms that frequently occur during the nesting period.

In placing the nesting boxes in position, have them as nearly vertical as possible. Should they incline at all, let them tip slightly forward rather than backwards.

Boxes designed for bluebirds and tree swallows, and placed in the open where they are exposed to the full glare of the sun, should be painted white, and also have a few quarter-inch holes bored in the sides, about an inch below the top, for ventilation.

Wood is the only suitable material for the construction of nesting boxes, and boards are obtainable anywhere throughout this land of ours, so that by following the above instructions the farmer, the schoolboy and the commuter may construct a bird house that will be accepted by the birds, and at the same time enjoy both the pleasure and the satisfaction of doing the work himself.

Placing the nesting boxes in position after completion does not complete the responsibility of the landlord. The farmer plants corn, but in order to reap a harvest he must remove the weeds that spring up. The same applies to the bird houses. Without watchfulness on our part they will be pre-empted by English sparrows and squirrels, and an unceasing warfare must be waged upon these pests. Number your bird houses and keep a record of the number and kind of species that use them during the season. Numbers may be placed at the foot of the tree or pole upon which the box is placed, or on the bottom of the box itself.

The insect that birds seem to care the least about, unfortunately, is the gypsy moth. Many observations and experiments have been made with a purpose of determining to what extent birds can be depended upon to aid in the control of this insect. It is generally conceded, however, that the gypsy moth is so hairy and, in fact, bristly during its larval stage, when the birds would naturally seek it for food, that it really is objectionable and distasteful to them.

One of the insects that at the present time is very destructive, especially to our shade trees, is the leopard moth. This insect develops into a large, fleshy, boring larva which lies in the branches or trunks of the trees, and the woodpeckers are our best assistants in devouring them. These birds should be encouraged as much as possible.

There has been much concern in the past about the effect of spraying with arsenate of lead upon bird life, but after a careful study of the subject by Mr. Forbush, the State Ornithologist, he became convinced, as published in his report of 1909, that spraying was a benefit rather than a hindrance to bird life. Where the trees are not sprayed, and defoliation takes place, the birds are the first to leave. Where the foliage is retained by spraying, thus giving shade and protection, here birds are found in large numbers.

For further information on bird-house construction the reader is referred to Farmers' Bulletin No. 609, United States Department of Agriculture, Washington, D. C. This bulletin is sent free upon application and is very valuable.

A new handbook, "The Conservation of our Wild Life," published by the Massachusetts Fish and Game Protective Association, price 35 cents, treats on methods of attracting and increasing our useful birds and the establishment of sanctuaries.

For detailed information on birds in general, of course the reader is referred to Mr. E. H. Forbush, the Massachusetts State Ornithologist, Room 136, State House, Boston, Mass.

The Army Worm Outbreak.

One of our native insects which at times appears so abundantly as to be regarded by the farmer and agriculturist as an extremely dangerous pest, and one against the ravages of which prompt and vigorous action should be taken, is the army worm, *Heliophila unipuncta.* This insect is found from the Atlantic Ocean to the Rocky Mountains and from Canada to Texas. Fortunately, serious outbreaks of this species are not frequent in Massachusetts.

Beginning about the middle of July, 1914, the State Forester's office began to receive, through the mail and otherwise, many specimens of this insect sent in by citizens from several sections of the State for identification. The large number of insects thus received, together with the receipt of many letters describing it, made it obvious that the State was suffering from an invasion of the dreaded army worm.

On July 28 His Excellency Governor Walsh, recognizing the importance of adopting remedial measures to relieve conditions, addressed to the State Forester the following letter: —

Mr. F. W. Rane, *State Forester, 6 Beacon Street, Boston.*

Dear Mr. Rane: — My attention has been called to the fact that serious injury is being wrought in various sections of the Commonwealth by the presence of the army worm, which is attacking and destroying crops.

I am of the opinion that your department, acting in co-operation with the Board of Agriculture, should at once request a sufficient number of your local moth superintendents to advise with farmers and others in the communities affected as to the best means of suppressing this destructive pest.

I understand the State Board of Agriculture and your own department have already sent out a large number of notices containing instructions, but it would seem that the situation now would require the employment of active agents in the various sections.

In view of the fact that you have no funds available for this work, I am convinced that this is such an emergency that would justify my asking the Executive Council to supply the sum of money necessary to direct the work of suppressing this pest.

I would also suggest that spraying apparatus owned wholly or in part by the town, or jointly with the State, should be brought into use as far as possible in carrying on this work.

In conclusion, I would also ask that the gypsy moth field agents and inspectors employed by your department be given instructions to aid and co-operate with the local moth superintendents in the infested areas. I would suggest that the widest publicity be given to the presence of the army worm in the Commonwealth, because it is a well-known fact that if precautions are taken the harm and injury wrought by this pest can be minimized.

Yours very truly,

David I. Walsh.

Upon receipt of the above letter the State Forester caused a circular letter to be sent to the mayors of cities and selectmen of towns, informing them of the purpose of the Forestry Department to co-operate with them in suppressing the pest. The form of the letter follows: —

Gentlemen: — By request of His Excellency Governor Walsh, this department will co-operate with cities and towns in suppressing the so-called army worm, which in some sections of the State is causing serious damage to crops. Local superintendents will be asked by this department

Fighting the army worm. One of the simplest and most effective methods of checking the spread of the army worm is to plow a furrow in advance of their march. They fall into this trench and are unable to get out. Taken at Bridgewater, Massachusetts.

to aid property owners in suppressing this insect. If it is found necessary to incur any expense in carrying on this work such expense will be borne by the Commonwealth. Local superintendents have been advised by agents of this department that all bills, after being approved by the division superintendent, must be forwarded to the office of the State Forester. It is distinctly understood that no part of such cost shall be borne by the city or town wherein the work is performed.

Very truly yours,
F. W. Rane,
State Forester.

Instructions were immediately given to the State field agents, employed in the gypsy and brown-tail moth work, to render to cities, towns and private owners within their respective districts all possible aid in the work of extermination.

The thorough training of the gypsy moth men in insect-suppression work, and the fact that the moth department of each city and town is well equipped with spraying apparatus, made it possible to apply quickly and effectively the necessary measures of suppression. The presence of the army worm was reported to the State Forester's office from the following-named towns: —

Abington.
Arlington.
Athol.
Attleboro.
Barnstable.
Berkley.
Boston.
Bourne.
Braintree.
Brewster.
Brighton.
Brockton.
Carver.
Chatham.
Chelmsford.
Cohasset.
Dartmouth.
Dighton.
Duxbury.
East Bridgewater.
Easton.
Edgartown.
Fairhaven.
Fall River.
Falmouth.
Gloucester.
Halifax.
Hanover.
Hanson.
Harvard.
Harwich.
Hingham.
Holbrook.
Longmeadow.
Mansfield.
Medford.
Middleborough.
Milford.
Nantucket.
Newbury.
North Andover.
Northbridge.
Norton.
Norwell.
Oak Bluffs.
Pembroke.
Plymouth.
Plympton.
Raynham.
Rochester.
Rockland.
Rockport.
Salisbury.
Scituate.
Seekonk.
Somerset.
Taunton.
Tisbury.
Topsfield.
Wareham.
West Boylston.
West Bridgewater.
Weymouth.
Whitman.
Worcester.

STATE FORESTER'S EXHIBIT AT THE PANAMA-PACIFIC EXPOSITION.

An appropriation of $3,000 was made this department by the Board of Managers for Massachusetts for making an exhibit at San Francisco. This has been spent in getting together the following material: —

(1) A large relief map of the whole State in which the forest and agricultural areas are shown. The forest-fire lookout stations are all located on this map by miniature towers; also the various State and private reservations are painted in. The State Forester was fortunate in securing the services of Mr. Warren Manning, landscape architect, of Boston, who had full charge of the construction. This map is 15 feet long by 6 feet wide, and is the exact size of the United States geological maps. This map will prove of great value after the exposition is over, as it can be used for many purposes by this department.

A duplication of this map was also made for the State Board of Agriculture, which has been colored to show the lands adapted for general agriculture in contrast to the present conditions as shown on the forestry map. The two maps are to be in adjoining booths at the exposition, which will add to their value.

(2) A fully equipped Massachusetts forest-fire wagon, similar to those used in our towns.

(3) A miniature steel lookout station of our own design.

(4) A large-sized, fully equipped power sprayer, a facsimile of those constructed and used in the moth work in Massachusetts.

(5) Two cases of colored transparencies, each containing 48 pictures, showing Massachusetts forestry and moth conditions and work. These pictures are each 8 by 10 inches in size, and electric fixtures are so arranged that the artificial light brings out their coloring.

(6) Several large sketches of typical Massachusetts scenery painted in colors by Mr. Manning will be used on the wall space.

(7) Various maps and placards, showing forestry data, publications, etc.

This material is all of such a nature that it can be used in this department when the exposition is over.

National Association of Conservation Commissioners.

The State Forester was elected secretary of this association at its meeting in Washington, D. C., in 1913, and the annual meeting this year was held at New Orleans, La., at the invitation of the State Conservation Commission of Louisiana. The meetings were held at the St. Charles Hotel, New Orleans, from Monday, November 16, to Thursday, November 19, after which the Louisiana Conservation Commission extended invitation to the delegates for a trip to the mouth of the Mississippi River, where an exceptional opportunity was offered to see and study wild life and the fish and oyster industries of the section.

The subject, "Forests as Nurseries of Wild Life," was the topic on the program discussed by the author. The subject of wild life, and the importance of national and State laws regulating the same, particularly in the case of migratory birds, was given due consideration.

The Massachusetts State Forest Policy.

Each year has seen a gradual step forward in our forestry work in Massachusetts, until sufficient fundamental legislation has accumulated so that it is not boasting, it is believed, to say that we now have in this State a well-rounded-out forest policy. It was with the idea of calling attention to this fact that the State Forester prepared and delivered the following paper before the Society for the Promotion of Agricultural Science, which held its annual meeting at Washington, D. C., on Nov. 10, 1914, a copy of which is as follows: —

The Massachusetts State Forestry Work.

It is believed that we are still woefully lacking in the United States in being unable to show more results from the practice of modern forestry. In analyzing the situation it cannot be attributed to lack of enthusiasm and willingness on the part of the men in the profession. For some reason the owners of the larger tracts of forest lands seem interested, but nonactive, and real operating lumbermen change their methods relatively slowly. Public, national and State undertakings in forestry, from the standpoint of constructive and businesslike methods, seem to be lacking in vigor. Lack of funds to do with would appear to be the trouble; but why should this be, if the investment will warrant the expenditure? I believe the greatest weakness in forestry at present is the lack of stalwart men able to convince our Legislatures, business corporations and men of affairs of the great importance of doing something on a much larger and more comprehensive scale than we have yet accomplished. Planting a thousand or two trees, or thinning and practicing modern forestry methods on a 5-acre tract here and there, are but drops in the bucket as compared to what ought to be undertaken in forestry in our various States and throughout the nation. Had we attempted to dig the Panama Canal under the same momentum that we are practicing forestry to-day, it is questionable if it would ever have been completed; we, however, are allowing our lands adapted for splendid forest crops to lie idle, and worse than that, not even forest fires are kept under control.

Up to the present time most American foresters have looked wise, given a great deal of advice, written pamphlets and books, and kept up a very good propaganda of forestry interest, but we have still, it is believed, a great lack of results that will come only when the fundamental problems have been given deeper root.

In calling attention to the work in forestry in Massachusetts I preface my remarks thus because it has not been a question of object lessons, examples and demonstrations to follow, but a working out of our State system by our own efforts.

Before the States began to have foresters, the United States Forest Service offered advice and assistance throughout the nation. During this time many examinations and recommendations by experts were made for Massachusetts people, but strange to say, when these same documents were checked up for results later it was found very little had been accomplished. The work on behalf of the forest service was well executed, and the owners were evidently interested in the beginning, but the work failed to be carried out simply because it was not followed up and kept alive by further personal contact. One thing has been conclusive thus far in our experience in Massachusetts, and that is, if anything tangible is to result in forestry work it must first be demonstrated by technical men right in the State; then our farmers and lumbermen will know we are advocating what can be accomplished from actual experience. The more real and definite examples a State forester can have scattered about his State, the sooner will he be able to make headway toward bettering general forestry conditions. Object lessons not only educate, but encourage action.

During the past eight years, year by year, through kindly consideration and definite legislation, the members of our General Court, enthusiastically headed by our public-spirited Governors, have given us statute after statute, until I am pleased to say I believe we now have a thoroughly well-rounded-out Massachusetts State forest policy. I am frank to say that I know of no State in the Union wherein the individual who cares to practice modern forestry can get more co-operation on the part of the State than in Massachusetts. While it is not the State's policy to actually give anything away, we nevertheless are so solicitous over ultimate success that we are doing everything possible to encourage our people to practice modern forestry.

I do not care to weary you by citing all of our various laws which are the foundations of our State forest policy, as they can be had in their printed form, but I do wish to point out briefly what is being done for forestry in Massachusetts.

(1) Expert forestry services are given at no expense, except travel and subsistence, to anybody in Massachusetts. Blank forms for requesting such assistance are available from the State Forester's office, Boston.

(2) In addition to expert advice, the State Forester's office has published, for free distribution, bulletins on the subjects of chief interest, as follows: —

Forest Thinnings.
Reforestation and Nursery Work.
Mensuration of White Pine.
Forest Fire Control and Management.
The Chestnut Blight Disease.
What is Forestry.
How and when to collect White Pine Seed.
Forest Taxation, etc.

(3) *Organization.* — The State Forester has general supervision. He is given trained assistants in the various branches represented in State work. The assistant in forest-fire work is given the title of State Fire Warden. Each town and city in the State has an officer known as forest warden. This officer is appointed by the officials of the town or city, and his appointment is subject to the approval of the State Forester. The local forest warden is clothed with enough power to get results in his jurisdiction. Some of his powers and duties are as follows: —

(*a*) No warrants can be paid for fighting forest fires without his approval.

(*b*) May compel any citizen between the ages of eighteen and fifty-one to assist in fighting forest fires, or may compel the use of teams and implements of another for similar use.

(*c*) No fires are set out of doors from March to December without a permit from him.

(*d*) The power to arrest without a warrant where persons are caught setting fires.

(*e*) Appoints his deputies.

(*f*) Has charge of local forest-fire apparatus.

(*g*) Pastes forest fire notices.

(*h*) Has responsibility of controlling brush and slash disposal.

(*i*) Gives assistance to assessors when called upon to secure data for forest taxation.

The State is divided into four parts, and each of these divisions is looked after by a so-called district forest warden. This man is appointed by the State Fire Warden, and is supplied with a runabout auto. It is the duty of the district forest wardens to supervise the work of fire protection within their respective districts. They have charge of the observation stations within their districts, receive reports from the observers each week, and are at all times subject to the call of each observer to attend any disastrous fire. They shall visit all towns within their districts, instructing the town forest wardens and deputy forest wardens relative to their duties, making such recommendations as in their judgment will improve the service. They shall inspect all forest fire-fighting apparatus, seeing that the same is in perfect condition and in readiness for an immediate response to an alarm of fire. They shall visit the selectmen of the different towns, advising them as to the necessity of properly providing their towns with forest fire-fighting apparatus. They shall report the number of each locomotive operating in their district not properly equipped with spark arrester, as required by law, and whose ash pan and grate are not sufficiently protected from setting fires. They shall submit to this office a weekly report showing the work accomplished by them each day, and shall report to this office any inefficiency or neglect of any observation man, forest warden or deputy.

The surface of the State of Massachusetts is of a rolling nature and particularly well adapted for fire lookout stations, by utilizing its higher hills and mountains. During the past three years 26 of these stations have been in operation throughout the State. At first improvised towers were used, but now substantial ones of steel construction ranging in size from 40 feet high, which is the standard, to 75 feet. The accompanying map indicates their distribution over the State.

The position of observer on the lookout station is the most important position under our present forest fire system. The future preservation of the forests of the State of Massachusetts depends largely on the men in charge of these stations. If they are alive to the situation, and appreciate the importance of the position they hold, disastrous fires within this State will be eliminated.

Each observer has under his supervision over 400,000 acres of land, a large percentage of which is valuable forest land. He is equipped with a field glass and the best map that can be obtained, and has the names and telephone numbers of every town forest warden and deputy forest warden within his territory. There has also been placed in each station a time-clock, to be punched every half hour, showing the exact time the observer is at his station, and the daily slips are to be forwarded, with the weekly report, to the State Fire Warden at the end of each week. The clock system affords a protection not only to the State, but to the man in charge of the observation station as well. Each observation man is directly under the supervision of the district forest warden, and shall forward him a copy of his weekly report. He must become thoroughly familiar with the territory under his supervision, studying the map and country carefully, becoming familiar with the names of the different mountains, hills, streams, ponds, roads, trails, railroads and trolley lines. He should know the local names which prevail in the region, the settlements where help may be collected quickly in case of fire, and the telephone connections in all directions from the station. All such information will assist in getting help to a fire as soon as smoke arises.

The weekly report has printed instructions on the back. This report is to be filled out each day, regardless of whether any fires are observed or not. If there are no fires, one line should be used each day, showing weather conditions, wind, etc. All fires observed must be reported. The observer must be very particular about the location of a fire, time observed, who notified, time of notification and time extinguished. He should keep his telephone in working order, calling up the central office each morning and after storms, to determine whether or not the line is in working order. If it fails to work he should go over the line and try to find breaks, and get it in working condition as promptly as possible. He should not open, disconnect or interfere with the telephone instrument in any way until he is absolutely satisfied that the line is not in perfect order. If it becomes necessary to examine the instrument, unless he is perfectly familiar with the construction and repair of the telephone he should not interfere with it in any way, but get a competent telephone man to make the necessary repairs. In case of inattention of any of the town forest wardens or their deputies he should notify the district forest warden and the State Forester's office.

(4) *Forestry Conventions.* — In order to enable the various officials to keep in close touch with the forest wardens throughout the State, and also to enable neighboring groups of wardens to discuss methods, equipment, etc., the State Forester is allowed to spend not exceeding $2,000 for conventions during a year. While forest fires, their control and management form a very important part of the program, such subjects as reforestation, thinning and general forestry improvement practices are discussed.

(5) *State Aid for Forest-Fire Equipment.* — Massachusetts expects its towns with a valuation of over $1,750,000 to be able to support its own forest-fire equipment, but all towns having a valuation below this amount the State agrees to reimburse for 50 per cent. of an expenditure not to exceed $500. This has encouraged our poorer towns to greater protection. The forest-fire lookout stations have been built usually on the co-operative plan, the towns covered paying one-half and the State the remainder.

(6) *Utilization.* — No more important part of forestry needs attention than does that of finding the best use for all products. Massachusetts was the first State to publish a bulletin on "Forest Utilization." This was done in co-operation with the United States Forest Service. We are at present continuing these studies, and have some very promising experiments being carried on.

(7) *Brush and Slash.* — One of the great causes for the larger forest fires, and hence those of greatest damage, has come from fire getting into old slashings or brush left from operating lots. A law was enacted last year, taking effect Jan. 1, 1915, making it compulsory for every one

operating a tract of forest land to leave a 40-foot strip free of slash or brush, as a natural fire prevention line, along the highways, railroad locations and all abutters' lands where there is danger from fire.

(8) *Railroad Fires and Railroads.* — A State law compels all railroad engines to carry spark arresters, and by an order from the Public Service Commission all engines running in Massachusetts are subject to examination by agents deputized for this work. The commission has a special man in charge of this inspection, and the State Fire Warden also permanently assigns one of his deputies to overcoming railroad fires. They are experts on the inspection of spark arresters, ash pans, grates, etc.

The signal for all forest fires is a whistle of one long and three short blasts, and all engineers are required by law to comply with it.

By a Massachusetts law all expenses a town or city may have incurred in extinguishing railroad fires are reimbursed by the railroads responsible. This is in addition to the property damages themselves.

Since these enactments far better co-operation has resulted, and railroad fires are rapidly diminishing.

At our forest warden conventions the railroads are always represented.

(9) *Forest Taxation.* — Few subjects have received more agitation in Massachusetts than this one. An amendment of the State Constitution — a process of several years — was found necessary, followed by confirmation on the part of the people. Last year, however, the recommendations of a special forest taxation commission were adopted. At present, therefore, we have a modern system of taxing forest lands. Briefly, there is an annual tax upon the land at cut-over valuation, and then a so-called products tax is assessed when the products are harvested. This law safeguards any one who desires to invest in forestry from being imposed upon, and, as well, expects from the owner recognized methods of culture.

(10) *Reforestation Assistance to Owners.* — A Massachusetts law is in force whereby any one having a tract of forest land adapted to reforestation may, by turning the title over to the State Forester, temporarily have it reforested for him at cost. The tract is then supervised by the State Forester until the owner cares to redeem the same. The period for redemption is ten years, and thereafter it becomes the property of the State. This law has been very popular, and has enabled the State Forester to start forestry work in many sections where individuals would not have the time or feel experienced enough to undertake the work. As the law contemplated scattering the work over the State as demonstrations and object lessons, the tracts thus planted range from 10 to 80 acres. The State in some instances has bought tracts for such use, but in this case the law restricts the acreage in any one year to 80 acres. When land has been thus handled for the individual, and has been redeemed, the owner is required to thereafter handle the plantation according to modern forestry methods.

In doing this work the State Forester of course is anxious to demonstrate and satisfy the owner that the work is economically and properly done. This encourages others to do similar work who do not care to turn the title over to the State. Either method is getting results, and that is the goal in view.

(11) *Causes and Numbers of Forest Fires.* — Each season we have secured more definite data as to causes of fires, and through a better checking up system practically all fires are now reported to the State Fire Warden. Blank forms are filled out by the forest warden after each fire, and mailed to the State Forester's office. With the causes of forest fires well understood it is less difficult to study out ways and means of obviating them.

(12) *State Forests.* — Our recent Legislature enacted a law empowering the Governor to appoint two State Forest Commissioners who, with the State Forester, are to purchase lands for State forests. The sum of $90,000 was appropriated for this purpose. The commission is restricted in the purchase price of the proposed forests. They are not allowed to pay over $5 an acre on the average. The policy of the State is to establish these proposed forests on lands now unproductive and likely to remain so, did the State not step in and reclaim them for forestry. Already the commission has gone over the State quite thoroughly, and many prospective tracts are in view. These tracts will give the State Forester an opportunity to demonstrate forestry on a more pretentious scale.

(13) *State Forest Nurseries.* — The State of Massachusetts grows its own small trees. A nursery of 7 acres is established on the farm of the Massachusetts Agricultural College at Amherst, and another of 4 acres is located at Barnstable on the Cape. Last year our inventory showed 7,000,000 trees, and our seed beds are increased in numbers this season.

A nursery has been started at the Massachusetts State Farm at Bridgewater, and this will be enlarged upon for transplant stock next season. With the advent of State-owned forests we will need a large output of young stock.

(14) *Lectures and Exhibitions.* — The State Forester and his assistants are called upon for talks and lectures by many organizations, colleges, schools, boards of trade, etc., and it has been through this medium that many people have become interested in forestry. The State Forester alone gave fifty-four talks and lectures one season. This season the department has a new feature in demonstrating its work by moving pictures. Numerous exhibits are made of the State work each year at various fairs, food shows, sportsmen's shows, etc. A State Forester's exhibit is being prepared at the present time for the Panama-Pacific Exposition at San Francisco next year.

(15) Other regulations worthy of mention are: —

(*a*) Power of the Governor to issue a proclamation closing the open season for hunting in dry times. This action was taken in the State this fall for the first time in many years.

(*b*) Boy scouts are voluntarily becoming our best forest-fire fighters. Co-operative encouragement here brings remarkable results.

(*c*) Fish and game deputies have the same authority in many respects as forest wardens. They are required to report all fires to the forest wardens.

(*d*) The rural mail carriers who penetrate practically every forest section of the State are required to report all forest fires to the forest wardens in their territory. Three hundred carriers throughout the State, traveling a total mileage of 6,000 miles each day, are of great assistance in getting help to extinguish fires in their incipiency.

In conclusion, I trust I have at least given you a general idea of what the Massachusetts State forestry work is. Much more might be pointed out, as, for example, the great undertaking in the suppression of the gypsy and the brown-tail moths, which Massachusetts is doing at great expense, but which has already been discussed by the writer before this association.

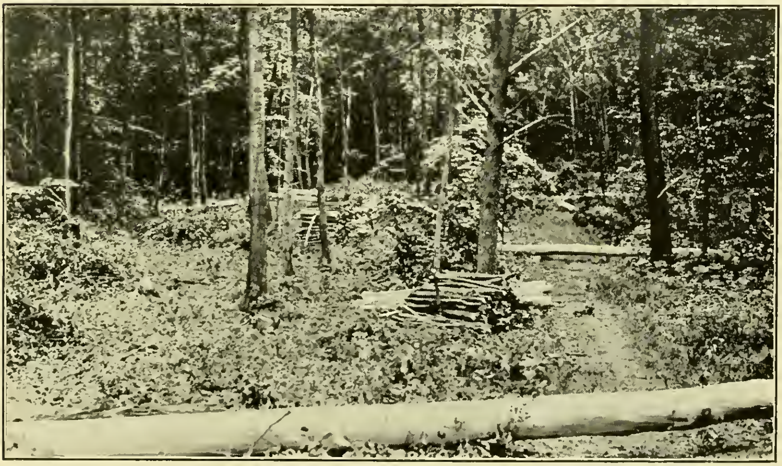
The most important point I wish to make is that the forestry work in Massachusetts has progressed, and now that enough laws and general regulations are at hand for encouragement in forestry it is believed we shall from now on see more rapid development along modern forestry lines.

LECTURES AND ADDRESSES.

The unabated interest felt by the citizens generally throughout the State in forestry matters is evidenced by the continual demands made upon the department by public-spirited organizations for lectures on the subject. While it was impossible to accept all the invitations received, speakers were sent to the following meetings: —

Brockton and Abington Boards of Trade.
Massachusetts State Board of Agriculture.
New England Forest Fire Conference.
Young Men's Catholic Union, Brookline.
Brotherhood of Hope Church, Springfield.
Farmers' Club of Leominster.
Men's Club, Newton Highlands.
Malden Natural History Club.
Oakham Farmers' Club.
Berkshire Meeting, Forest Wardens, Pittsfield.
Springfield Meeting, Forest Wardens.
Rural Progress Meeting.
Worcester Meeting, Forest Wardens.
Fitchburg Meeting, Forest Wardens.
Greenfield Meeting, Forest Wardens.
Farmers' Week, Massachusetts Agricultural College.
South Bristol Farmers' Club.
Short Courses, Massachusetts Agricultural College.
Haverhill Meeting, Forest Wardens.
Boston Meeting, Forest Wardens.
Middleborough Meeting, Forest Wardens.
Marlborough High School.
Massachusetts State Firemen's Association.
Cornell University — Forestry Dedication.
Marshfield Farmers' Club.
Old Colony Pomona, Bridgewater.
Middleborough Farmers' Meeting.
Quaboag Pomona Grange, West Brookfield.
Cape Cod Cranberry Growers' Association.
New Hampshire State Board of Trade.
Oxford Pomona Grange.
Harvard Single Tax Colony.
Wakefield Grange.
Newton Forestry Meeting.
West Roxbury Women's Club.
Massachusetts State Grange.
Worcester Board of Trade.
Winchendon Public Forestry Meeting.
Williams College Forestry Talks.
The Cottages Association, Cotuit, Mass.
Colony Club, Sagamore Beach.

Dinner hour in the lumber camp, Stevens estate, North Andover.



Improvement thinning in a mixed stand of chestnut and pine, where the chestnut was affected with blight. The pine is left standing to reseed the land.

State Grange Meeting, Southwick.
State Grange Meeting, East Longmeadow.
State Grange Meeting, Greenwich.
Winter Hill Improvement Association.
West Medway Grange.
Bridgewater Grange.
New England Florists' Association, Horticultural Hall.
Fitchburg Women's Club.
Holden Improvement Society.
The Princeton Grange.
Franklin Farmers' Club.
State Board of Trade.
Old Colony Pomona Grange.
Field Day at Lincoln.
Westminster Grange.

Field Meetings of the State Grange.

It may be said without fear of exaggeration that the people of Massachusetts come nearer to applying the intensive method to their industrial and agricultural interests than any other section. This spirit in enterprise and progress is demonstrated in many ways, but in none with more marked effect than by the work of the Patrons of Husbandry. The organized efficiency of the grange is well known and is of a high order, and is made possible by the unselfish personal service given to its endeavors by both the officers and members. A fact which is more and more apparent as the years go by is that as an organization it has become a powerful factor in accomplishing those ends calculated to promote to the fullest extent the social and industrial life of the community.

It has been the custom of the State Grange during the past few years to hold summer field meetings in various sections of the State. These meetings have been very popular with the members of the order and have been largely attended. At each meeting speakers have been provided to discuss matters relating to the welfare of the Commonwealth. The summer field meetings for 1914 were as follows: —

Middlesex Essex Pomona, Wilmington, Silver Lake.
Cape Cod Pomona, Cotuit.
Chebacco Pomona, Gloucester, Riverdale Park.
Worcester Central Pomona, Worcester, Green Hill Park.
Berkshire County, Pittsfield, with J. H. Noble.
Western Hampden Pomona, Southwick, with F. D. Lambson.
Worcester East Pomona.
Middlesex Worcester Pomona, Ayer, Ayer Park.
Middlesex North Pomona, Tyngsborough.
Worcester Norfolk Pomona, Mendon.
Hampshire Pomona, Amherst.
Springfield Pomona, East Longmeadow.
Swift River, Greenwich Plains.
Old Colony Pomona, Bridgewater.
Essex County Pomona, Canobie Lake.
Boro Pomona, Westborough.
Worcester West Pomona, Winchendon, Lake Dennison.
Connecticut Valley Pomona, Greenfield, Shattuck Park.
Mayflower Pomona, North Hanson.

Middlesex Norfolk, Cochituate.
Quaboag Pomona, West Brookfield.
Worcester Southwest, Sturbridge.
Norfolk Pomona, Norwood.
Deerfield Valley Pomona, Colrain.
Hillside Pomona, Cummington.
Berkshire South, Lake Buell, Sumner's Landing.
Worcester Franklin, Brookside Park (Athol and Orange).
Middlesex Central Pomona.

The State Forestry Department was represented at many of these meetings by State Forester F. W. Rane, or the secretary, Mr. C. O. Bailey, at all of which meetings an enthusiastic interest was shown in the work of the department as described by the speakers.

WORK ON STATE HIGHWAYS.

The usual custom of this department having supervision of the insect work along the State highways throughout the moth-infested district, has been carried out again this year.

Work was done in the following cities and towns on the State highways, and paid for by the Highway Commission: —

LIST OF HIGHWAY WORK, 1914.

Abington,	$20 34	Chatham,	$18 25
Acton,	156 63	Chelmsford,	105 10
Amesbury,	114 51	Chester,	112 88
Amherst,	41 63	Cohasset,	40 41
Andover,	87 33	Concord,	231 04
Ashburnham,	73 75	Deerfield,	12 25
Ashby,	53 50	Dennis,	18 00
Ashland,	32 58	Dover,	40 65
Athol,	34 40	Dracut,	68 40
Attleborough,	16 50	Duxbury,	30 94
Auburn,	27 58	Essex,	27 51
Ayer,	33 76	Falmouth,	121 80
Barnstable,	358 00	Fitchburg,	65 76
Barre,	58 00	Foxborough,	94 93
Bedford,	89 45	Framingham,	104 40
Bellingham,	12 70	Franklin,	37 50
Beverly,	290 79	Gardner,	13 20
Billerica,	69 25	Gloucester,	21 00
Bourne,	157 06	Grafton,	83 75
Boxborough,	128 65	Greenfield,	27 00
Braintree,	22 38	Groton,	37 29
Brewster,	36 00	Groveland,	59 26
Bridgewater,	26 57	Hadley,	71 38
Brookfield,	76 95	Hamilton,	106 33
Burlington,	99 75	Hardwick,	28 84
Canton,	11 70	Harvard,	46 81

List of Highway Work, 1914 — *Concluded.*

Harwich,	$4 50
Haverhill,	132 45
Hingham,	27 63
Holbrook,	14 00
Holliston,	63 02
Hudson,	44 46
Huntington,	104 56
Ipswich,	44 50
Lakeville,	9 75
Lancaster,	55 10
Leicester,	29 00
Leominster,	64 00
Lexington,	94 45
Lincoln,	65 35
Littleton,	72 80
Lowell,	42 68
Lunenburg,	71 40
Marion,	18 00
Marlborough,	228 65
Marshfield,	42 86
Mashpee,	5 50
Melrose,	33 00
Merrimac,	41 97
Methuen,	85 35
Middleborough,	13 44
Middleton,	14 75
Montague,	20 05
Natick,	59 41
Needham,	38 36
Newbury,	88 53
Newburyport,	38 00
North Andover,	177 45
North Attleborough,	58 05
North Reading,	54 50
Northborough,	105 00
Northbridge,	19 83
Northfield,	72 50
Norton,	40 67
Orleans,	35 60
Palmer,	44 19
Pembroke,	5 11
Pepperell,	68 47
Pittsfield,	64 00
Plainville,	25 15
Princeton,	14 00
Quincy,	29 97
Reading,	120 25
Rehoboth,	47 20
Rockland,	29 69
Rockport,	$13 00
Rowley,	101 17
Russell,	61 45
Salisbury,	95 88
Sandwich,	38 00
Scituate,	150 20
Seekonk,	50 00
Shrewsbury,	117 80
Somerset,	150 00
South Hadley,	77 00
Southborough,	60 96
Spencer,	21 05
Sterling,	100 50
Stoneham,	88 30
Stoughton,	21 25
Sudbury,	219 30
Sutton,	12 31
Swampscott,	4 00
Swansea,	126 25
Taunton,	23 75
Templeton,	73 30
Tewksbury,	78 39
Townsend,	125 00
Truro,	10 50
Tyngsborough,	169 08
Ware,	53 50
Warren,	44 54
Wayland,	102 83
Wellfleet,	44 50
Wenham,	94 25
West Boylston,	51 11
West Bridgewater,	28 11
West Brookfield,	44 54
West Newbury,	115 62
Westborough,	39 27
Westfield,	118 85
Westford,	184 00
Westminster,	19 35
Weston,	96 00
Westwood,	12 25
Weymouth,	130 50
Whitman,	19 95
Wilmington,	66 74
Winchester,	67 25
Woburn,	206 19
Worcester,	29 54
Yarmouth,	47 20
	$10,038 12

PARASITE WORK.

REPORT OF MR. A. F. BURGESS, IN CHARGE OF MOTH WORK, PARASITE LABORATORY, MELROSE HIGHLANDS, MASS.

JAN. 12, 1915.

DEAR PROFESSOR RANE: — Dr. L. O. Howard, chief of the Bureau of Entomology, has requested me to prepare a brief report on the parasite work for the year 1914. The information enclosed relates particularly to conditions in Massachusetts, and is of especial interest to the citizens of this State.

Very truly yours,

A. F. BURGESS,
In Charge of Moth Work.

The plan for conducting the parasite work of the gypsy and brown-tail moth has been to collect and rear the most important natural enemies of these insects, and colonize them in territory remote from where the parasites had already spread. This was done in order to enable the beneficial species to become established over the entire infested territory as rapidly as possible. In order to secure further information in regard to the work of the parasites of the gypsy moth in Europe, Dr. John N. Summers, one of the assistants in the Bureau at the Gypsy Moth Laboratory, visited Germany during the spring and summer of 1914.

Unfortunately, severe gypsy-moth outbreaks did not exist in Germany this year, so that he was not able to obtain as much information as was anticipated. He visited, however, a number of large forests in Hungary where the gypsy moth was present in large numbers, and secured some data concerning the habits of this insect in its native home. Owing to the fact that he did not receive information in regard to the presence of this gypsy-moth outbreak until late in the season, it was impossible to secure parasites for shipment to this country. No parasites have been imported during the present year.

During the spring of 1914, 1,500,000 specimens of *Anastatus bifasciatus* were colonized. Most of these were liberated in towns in northern Massachusetts, but a few towns in New Hampshire were also supplied. An examination of egg clusters from some of the colonies of this species which were liberated several years ago showed that the parasitism is sometimes as high as 43 per cent., and very commonly 25 per cent. of the eggs in a cluster are destroyed by this insect.

In the fall of 1914 collections in the field enabled us to rear at the laboratory large numbers of *Schedius kuvanae*, and over 2,000,000 specimens of this species have been colonized in 111 towns, 60 of which are located in Massachusetts. The colonization work in Massachusetts was begun in the Cape district, and extended in a crescent form to the New Hampshire line, plantings having been made in practically all the known woodland colonies of the gypsy moth in southern Massachusetts.

During the summer *Compsilura concinnata*, one of the species of *Tachinid* flies which has become most firmly established in this country, was found in many localities throughout the area infested by the gypsy moth. This species seems to occur locally, and it is sometimes present in large numbers in small and scattered moth infestations. One generation of this parasite usually develops on the caterpillars of the brown-tail moth in the early spring, and as the latter species was locally rather than generally common throughout the infested area last spring, this may, in part, account for the local rather than general distribution of *Compsilura*.

Apanteles lacteicolor, a parasite of both the small gypsy and brown-tail moth caterpillars, was not as abundant as usual this season. The larvæ of this species hibernate within the small brown-tail caterpillars in the webs during the winter, and as there was a heavy mortality of the brown-tail caterpillars during the winter of 1913–14, the number of *Apanteles* was seriously reduced.

Several other introduced parasitic species have been found in small numbers, but not common enough to cause any appreciable benefit. Another species of *Apanteles*, *Apanteles melanoscelus*, was found in satisfactory numbers in Melrose and vicinity. Only one colony has been liberated in this country, and this was the last species which was imported. It has survived two New England winters and gives promise of being a very satisfactory enemy of the gypsy moth. Several years, however, will be required for the insect to become abundant enough to spread over the infested area.

The *Calosoma* beetle, *Calosoma sycophanta*, was more abundant and was found over a larger area than in any previous year. A number of colonies were liberated in remote parts of the infested area. The work of this insect is very striking, and enormous numbers of the gypsy and brown-tail moth are destroyed by this species.

The summer of 1914 was unusually mild, particularly during June and early July. During this period the gypsy-moth caterpillars flourished and their numbers were not reduced to any great extent by the "wilt" disease until the caterpillars were nearly full grown. During the past two years the parasites and the "wilt" disease have made enormous inroads on the gypsy-moth larvæ during June and early July, but less reduction of the caterpillars took place this year over the entire infested area as a whole.

In many localities the gypsy-moth infestation has decreased materially, as a result of the work of natural enemies, but in some of the older infested territory, particularly south of Boston and on Cape Cod, a marked increase in infestation has been observed.

It is believed that a reduction will be made by natural enemies during the coming year, but the problem is very complex, and with our present knowledge it is impossible to state definitely what will happen next summer. Doubtless there will be seasons when an unexpected increase of the moth will take place, but the general trend for the past few years has indicated that the natural enemies are bringing about greatly improved conditions.

NEW LEGISLATION.

The Legislature of 1914 is fairly entitled to the credit of having enacted more important legislation calculated to advance the forestry interests of the Commonwealth than has been done in any previous year.

Forest Taxation.

Much has been said during the past few years with regard to the importance and desirability of a law which would change the unsatisfactory method of taxing wild and forest lands which has been in vogue in this State from time immemorial. The insistent demand of those interested in the subject culminated in the passage by the last Legislature of an act entitled, "An Act to provide for the classification and taxation of wild or forest lands." This bill was prepared by a commission appointed by the Governor for that special purpose. While the act is too long to be published in this report, the State Forester has recently issued a booklet containing a full text of the law with explanatory notes, which will be mailed to any one on request.[1]

Slash Law.

Another law, which if properly enforced cannot fail to be of great benefit in reducing the forest fire evil, is the so-called slash law.[2]

Injurious Insects.

The State Forester desires also to call attention to an act passed enabling cities and towns to suppress the tent caterpillar, leopard moth and elm beetle. This act was passed upon the petition of prominent town and city officials of the metropolitan district.[3]

State Forest Commission.

Chapter 131, Acts of 1913, creating a Forest Tax Commission, authorized said commission, in addition to a study of the tax problem, to "investigate the present policy of the commonwealth with regard to the acquisition and management of wild or forest lands and report what further legislation, if any, is necessary." In its report to the Legislature of 1914, the commission recommended the creation of a commission to acquire suitable lands for State forests. In accordance with the commission's recommendation, a bill was enacted by the Legislature.[1]

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[1] For text of forest taxation act, see "Agricultural Legislation of 1914," p. 335.

[2] For text of slash act, see "Agricultural Legislation of 1914," p. 334.

[3] For text of insect suppression act, see "Agricultural Legislation of 1914," p. 348.

FINANCIAL STATEMENTS.

General Forestry.

In accordance with section 6, chapter 409 of the Acts of 1904, as amended by section 1, chapter 473 of the Acts of 1907, the following statement is given of the forestry expenditure for the year ending Nov. 30, 1914: —

State Forester's Expenses.

Appropriation for 1914,		$20,000 00
Expenditures: —		
Salaries of assistants,	$6,188 82	
Traveling expenses,	3,030 69	
Stationery and postage, etc.,	327 87	
Printing,	31 98	
Maps, photographs, material, etc.,	297 80	
Equipment, tools, etc.,	223 66	
Sundries, including teaming,	133 13	
Nursery account: —		
Pay roll,	6,541 50	
Travel,	23 13	
Equipment,	1,836 99	
Seeds and seedlings,	711 41	
Express and freight,	583 78	
Sundries,	69 13	
		19,999 89
Balance returned to treasury,		$0 11

Purchase and Planting of Forest Lands.

Appropriation for 1914,	$10,000 00	
Receipts: —		
Wm. D. Sohier,	120 00	
Davis Hardware Company — rebate,	28 42	
		$10,148 42
Amount carried forward,		$10,148 42

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[1] For text of forest commission act, see "Agricultural Legislation of 1914," p. 346.

Amount brought forward,		$10,148 42
Expenditures: —		
Pay roll,	$9,186 44	
Travel,	99 60	
Tools and equipment,	272 69	
Express, freight and teaming,	247 47	
Telephone,	3 95	
Land,	330 00	
Sundries,	8 07	
		10,148 22
Balance returned to treasury,		$0 20

Prevention of Forest Fires.

Appropriation for 1914,	$23,000 00	
Receipts: —		
New England Telephone and Telegraph Company — rebate,	58	
Various towns for cans, brooms, etc.,	643 64	
Town of Falmouth,	350 00	
Town of Dartmouth,	150 00	
Town of Yarmouth,	100 00	
Town of Barnstable,	350 00	
City of Fall River,	225 00	
		$24,819 22
Expenditures: —		
Salaries,	$13,972 94	
Travel,	3,920 39	
Printing,	991 44	
Stationery and postage,	300 39	
Equipment,	1,390 21	
Construction,	3,203 52	
Telephone,	898 82	
Express, freight and teaming,	80 89	
Sundries,	59 60	
		24,818 20
Balance returned to treasury,		$1 02
Reimbursement for fire-fighting apparatus to towns,		$2,127 05

Suppression of Gypsy and Brown-tail Moths.

The balance shown on the general appropriation for the suppression of the gypsy and brown-tail moths, as carried at the end of the fiscal year, will be practically expended in reimbursements to towns and cities for the work of the year ending Nov. 30, 1914.

General Appropriation.

Balance on hand, Nov. 30, 1913,	$121,558 10
Less reimbursement paid for 1913,	48,310 36
Balance for 1914 work,	$73,247 74
Receipts: —	
Town of Braintree,	220 00
Town of Weymouth,	585 90
City of Lynn,	1,361 72
City of Quincy,	241 87
Town of Westborough,	404 43
Town of Natick,	87 80
Town of Southborough,	39 96
Town of Boylston,	518 07
Town of Dedham,	1,159 98
Town of Lincoln,	79 20
Town of Wellesley,	3 50
Town of Raynham,	37 42
Town of Maynard,	79 29
Town of Ayer,	110 36
Town of Andover,	204 68
Town of Ashland,	613 80
Town of Rochester,	29 35
Town of Easton,	12 50
Town of Topsfield,	1,974 51
Town of Royalston,	3 90
City of Medford,	1,040 94
Town of Milton,	2,391 15
Town of Hingham,	393 68
Appropriation for 1914,	125,000 00
Town of Arlington,	1,172 67
Town of Wakefield,	829 68
Dow Chemical Company,	15 26
Town of Braintree,	7 99
Amount carried forward,	$211,867 35

Amount brought forward,	$211,867 35	
Town of Stoneham,	47 12	
Salem Cadet Association,	113 95	
Town of Natick,	44 53	
Town of Milton,	18 50	
Harbor and Land Commission,	82 01	
Prevention of forest fires,	295 80	
Fall River Water Works,	47 80	
Dover gypsy moth fund,	2,236 10	
State Forester's expenses,	40 84	
Special North Shore fund,	5,655 77	
Appropriation for 1915,	75,000 00	
City of Quincy,	1,127 34	
Checks returned on Lexington and Princeton pay rolls,	7 00	
New York, New Haven & Hartford Railroad Company (for lost magneto),	57 75	
Balance on appropriation for exhibit at Food Fair,	16 01	
Town of Hopkinton,	1,142 60	
Use of outfit in thinning work,	101 50	
		$297,901 97
Office expenses: —		
Salaries of clerks,	$3,061 96	
Rent of offices,	2,409 96	
Stationery and postage,	1,661 53	
Printing,	1,387 94	
Office supplies,	281 25	
Sundries, including telephone, lights, express, etc.,	1,318 48	
Field expenses: —		
Pay roll,	44,493 86	
Travel,	9,228 01	
Supplies,	102,513 92	
Rent of supply store,	750 00	
Store equipment,	207 90	
Special work,	8,200 00	
Reimbursement to towns and cities,	31,104 25	
Sundries, including freight, express, teaming, etc.,	2,408 28	
		209,027 34
Balance on hand Nov. 30, 1914,		$88,874 63
Reimbursement paid December, 1914, and January, February and March, 1915, for the year 1914,		$39,670 10

Special North Shore Fund.

Balance from 1913,	$9,999 76	
Receipts: —		
City of Beverly,	3,500 00	
Town of Manchester,	3,500 00	
W. D. Sohier, agent,	7,000 00	
South End Improvement Association of Rockport,	190 00	
Town of Rockport,	200 00	
F. W. Rane, State Forester,	7,000 00	
Appropriation for suppression of gypsy and brown-tail moths,	3,448 83	
Town of Swampscott,	19 50	
F. W. Rane, State Forester (for Rockport work),	200 00	
Dover gypsy moth fund (for use of truck),	108 75	
		$35,166 84
Expenditures: —		
Pay roll,	$14,053 33	
Travel,	458 23	
Supplies,	10,443 72	
Rent,	296 20	
Stationery and postage,	3 53	
Store equipment,	8 60	
Sundries, including teaming and express,	1,572 53	
		26,836 14
Balance on hand Nov. 30, 1914,		$8,330 70

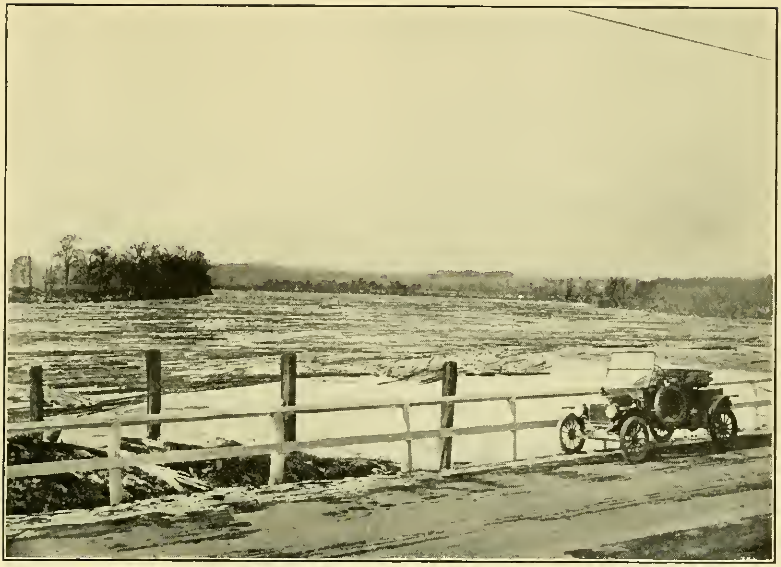
Dover Gypsy Moth Fund.

A special fund was created in August, 1913, for woodland work in the town of Dover, the work to be done in a co-operative manner, similarly to that done on the North Shore. A statement of the income of the fund and expenditures under it is given here, from the beginning of the work to the end of the present fiscal year.

Receipts: —	
Town of Dover,	$1,000 00
F. W. Rane, State Forester,	1,000 00
Town of Dover,	1,220 40
Amount carried forward,	$3,220 40

Amount brought forward,	$3,220 40	
F. W. Rane, State Forester,	2,000 00	
Union Lumber Company,	7 00	
Winthrop Harvey,	197 38	
R. E. Sherman,	93 80	
F. H. Dichl & Son,	1,133 96	
Richard Bragey,	2 40	
Appropriation for suppression of gypsy and brown-tail moths,	4 84	
J. E. Lonergan & Co.,	3 00	
Town of Dover,	1,000 00	
F. W. Rane, State Forester,	1,000 00	
Poore & Chadwick,	7 92	
Simpson Bros. Corporation,	65 25	
Geo. M. Cushing,	29 00	
Winthrop A. Harvey,	97 76	
W. Rodman Fay,	149 24	
Robert K. Rogers,	8 80	
Tools lost,	2 00	
Norfolk Hunt Club,	125 00	
Richard Smalley,	13 50	
Robert Baker,	3 50	
Turner Bailey,	4 00	
C. F. Eddy & Co.,	66 00	
Geo. D. Hall,	57 67	
Town of Dover,	1,000 00	
		$10,292 42
Expenditures: —		
Pay roll,	$6,788 54	
Travel,	52 09	
Supplies,	2,358 84	
Sundries,	31 13	
		9,230 60
Balance on hand Nov. 30, 1914,		$1,061 82

The following is a list of cities and towns, with amount of supplies for moth work furnished them, for the year ending Nov. 30, 1914. The amounts given are the gross amounts furnished, some of the cities and towns having made payments to the State Forester's office for all or a part of the amounts, according to the amount of their net expenditures or their



Logs in the boom at Connecticut River Lumber Company, Mount Tom Junction, Massachusetts. These logs have come down the river from the mountains of Vermont and New Hampshire.

Connecticut River Lumber Company, Mount Tom Junction, Massachusetts. The largest sawmill in the State.

class under the provisions of the law. For amounts received from this office in reimbursement and supplies see the table on page 97.

Third-class Towns.

Acton,	$695 97
Ashburnham,	114 38
Ashby,	46 05
Ashland,	100 55
Auburn,	131 02
Avon,	90 67
Ayer,	292 55
Bedford,	1,551 20
Berkley,	21 30
Berlin,[1]	1,720 60
Billerica,	814 96
Bolton,[1]	2,060 31
Boxborough,	652 18
Boxford,	490 58
Boylston,	62 31
Bridgewater,	480 53
Burlington,	503 01
Carlisle,	625 50
Carver,	667 93
Chelmsford,	1,185 21
Deerfield,	3 76
Dracut,	849 75
Dunstable,[1]	1,188 65
Duxbury,	202 35
East Bridgewater,[1]	1,930 39
Essex,	141 22
Georgetown,[1]	1,909 44
Groton,	754 94
Groveland,	163 23
Halifax,	22 76
Hamilton,	774 01
Hanover,	1,176 11
Hanson,	276 76
Harvard,[1]	2,405 56
Holden,	299 57
Holliston,	58
Hopkinton,	60 89
Hudson,[1]	1,976 21
Ipswich,	957 38
Kingston,	294 73
Lincoln,	1,700 38
Littleton,	697 82
Lunenburg,	676 75
Lynnfield,	567 44
Marshfield,	871 93
Mashpee,	253 03
Merrimac,	216 59
Middleborough,	$836 47
Middleton,	226 83
Nantucket,	40
Newbury,	531 58
Norfolk,	111 96
North Andover,	775 57
North Reading,	1,017 92
Northborough,	448 73
Norwell,	1,231 53
Pembroke,[1]	1,920 17
Pepperell,	571 79
Plainville,	150 97
Plympton,	284 34
Princeton,	682 96
Raynham,	47 45
Rowley,	608 57
Salisbury,[1]	1,874 54
Sandwich,	156 93
Scituate,	1,063 61
Sherborn,	326 74
Shirley,	405 15
Shrewsbury,	38 61
Southborough,	238 46
Sterling,	426 59
Stoneham,	675 69
Stoughton,	866 06
Stow,[1]	2,248 60
Sudbury,	746 22
Templeton,	243 73
Tewksbury,	1,018 45
Topsfield,	294 91
Townsend,	552 84
Tyngsborough,	1,021 85
Wayland,	922 70
Wenham,	571 71
West Boylston,	77
West Bridgewater,	366 55
West Newbury,	215 42
Westborough,	138 61
Westford,	912 82
Westminster,	130 62
Whately,	5 26
Wilmington,	812 67
Winchendon,	325 73
	$58,728 12

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[1] Received sprayer from State, town or city paying one-half the cost.

First and Second Class Towns and Cities.

Andover, ...	$864 17	Milton, ...	$18 50
Barnstable, . . .	456 98	Natick, ...	92 15
Braintree, . . .	7 99	Newton, ...	4,789 55
Canton,[1]	2,997 60	Quincy, ...	1,133 92
Cohasset, ...	1,990 67	Reading, ...	1,850 11
Concord, ...	785 41	Saugus, ...	1,027 34
Danvers,[1] . . .	1,967 97	Wakefield, ...	827 18
Gloucester, . . .	526 18	Waltham, ...	1,454 30
Hingham, . . .	1,258 18	Weston, ...	1,539 63
Lexington, . . .	931 09	Weymouth, ...	1,873 06
Lowell, ...	386 58	Woburn, ...	867 21
Marlborough,[1] . . .	2,486 28	Worcester,[1]	3,024 06
Medford, ...	640 40		
Methuen, ...	1,135 05		$93,659 68

[1] Received sprayer from State, town or city paying one-half the cost.

Dover gypsy moth fund, ...	$2,103 63
Fall River Water Works, ...	47 80
Forest fire prevention, ...	585 09
Forestry, ...	141 72
Pine Banks Park, ...	95 60
Forest thinnings, ...	286 16
Special North Shore fund, ...	5,647 41
Moth superintendents, etc., ...	197 62
Office, ...	3 19
Automobiles, ...	33 43
Supply store, ...	4 10
Traveling sprayers, ...	886 86
Total amount disbursed through supply store, ...	$103,692 29

FINANCIAL SUMMARY OF MOTH WORK BY TOWNS.

The following table shows the reimbursement, amount of supplies furnished and net amount received from this office by cities and towns for 1913, the required expenditure before receiving reimbursement from the State, the total net expenditure, the amount received for work on private property returned to this office, the amount paid in reimbursement, gross amount of supplies, and total net amount received from this office by cities and towns for 1914, and also the required expenditure for 1915. In the last two columns is shown the number of spraying outfits, both large and small, owned by each town or city.

Cities and Towns.	Class.	1913.			1914.						1915.	Spraying Outfits in Towns and Cities.	
		Re-imbursement.	Tools Supplied.	Total Amount received from State.	Required Expenditure.	Total Net Expenditure.	Private Work.	Re-inburse-ment.	Tools Supplied.	Total Amount received from State.	Required Expenditure.	Large.	Small.
Abington,	3	–	–	–	$1,403 51	–	–	–	–	–	$1,459 85	1	–
Acton,	3	$550 00	[1] $2,148 73	$2,098 73	975 90	$1,779 79	$275 00	$803 89	$695 97	$1,499 86	970 01	1	–
Aeushnet,	3	–	–	–	439 31	–	–	–	–	–	461 61	–	–
Amesbury,	2	–	–	–	2,626 67	–	–	–	–	–	2,681 87	1	1
Andover,	2	–	[2] 911 31	706 63	3,234 59	3,194 35	1,921 54	–	[2] 864 17	659 14	3,437 11	3	2
Arlington,	1	–	[2] 1,172 67	1,158 32	5,000 00	5,456 62	–	–	–	–	5,000 00	2	3
Ashburnham,	3	431 03	209 75	640 78	500 72	976 88	411 96	476 16	114 38	590 54	510 84	–	1
Ashby,	3	271 97	174 17	446 14	248 18	731 28	38 19	483 10	46 05	529 15	257 75	–	1
Ashland,	3	–	1,564 72	950 9	600 12	546 93	269 40	–	[2] 100 55	47 36	583 64	1	–
Athol,	3	–	–	–	2,342 62	–	–	–	–	–	2,603 15	–	–
Attleboro,	1	–	–	–	5,000 00	–	–	–	–	–	5,000 00	–	–
Auburn,	3	–	–	–	634 80	635 58	325 81	78	131 02	131 80	692 00	–	–
Avon,	3	175 20	47 80	223 00	431 88	692 94	88 90	261 06	90 67	351 73	446 40	–	1
Ayer,	3	–	[1] 1,804 80	1,204 80	927 85	[3] 1,017 57	340 05	116 68	292 55	409 23	928 05	1	–
Barnstable,	2	–	–	–	3,370 26	[3] 418 25	–	–	[4] 481 14	–	3,503 85	2	–
Barre,	3	–	–	–	1,053 58	–	–	–	–	–	1,089 64	–	–

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[1] Received sprayer from State, town paying one-half the cost, $600.

[2] Town paid part of the amount for supplies.

[3] Work financed by State.

[4] Town paid full cost of supplies.

Cities and Towns.	Class.	1913.			1914.						1915.	Spraying Outfits in Towns and Cities.	
		Re-imburse-ment.	Tools Supplied.	Total Amount received from State.	Required Expendi-ture.	Total Net Expendi-ture.	Private Work.	Re-imburse-ment.	Tools Supplied.	Total Amount received from State.	Required Expendi-ture.	Large.	Small.
Bedford,	3	$1,393 63	[1] $3,057 36	$3,850 99	$716 31	$2,158 11	$1,122 01	$1,441 80	$1,551 20	$2,993 00	$743 59	2	1
Bellingham,	3	-	-	-	382 26	-	-	-	-	-	401 72	-	-
Belmont,	2	-	-	-	3,297 49	-	-	-	-	-	3,530 53	1	2
Berkley,	3	68 28	43 80	112 08	208 21	263 46	65 68	55 25	21 30	76 55	225 43	-	1
Berlin,	3	775 79	237 52	1,013 31	249 31	1,269 00	368 81	419 69	[1] 1,720 60	1,540 29	259 20	1	-
Beverly,	1	-	-	-	5,000 00	-	-	-	-	-	5,000 00	1	-
Billerica,	3	75 41	603 61	679 02	1,385 80	1,723 64	680 38	337 84	814 96	1,152 80	2,211 97	1	2
Blackstone,	3	-	-	-	968 97	-	-	-	-	-	981 31	-	-
Bolton,	3	774 95	337 96	1,112 91	271 59	1,106 78	428 31	235 19	[1] 2,060 31	1,695 50	303 76	1	-
Boston,	1	9,849 89	-	9,849 89	5,000 00	30,167 55	14,272 57	11,752 43	-	11,752 43	5,000 00	-	-
Bourne,	2	-	-	-	3,057 72	-	-	-	-	-	3,132 73	1	-
Boxborough,	3	1,348 50	584 29	1,932 79	117 39	1,241 02	221 30	1,123 63	652 18	1,775 81	115 27	-	-
Boxford,	3	1,405 33	429 81	1,835 14	614 49	1,816 05	507 13	1,201 56	490 58	1,692 14	643 07	-	2
Boylston,	3	527 13	118 28	645 31	212 02	[2] 669 04	460 11	457 02	62 31	519 33	217 96	-	1
Braintree,	2	-	[1,3] 2,355 76	1,535 76	3,495 80	-	-	-	[4] 7 99	-	3,568 30	1	-
Brewster,	3	-	-	-	325 23	-	-	-	-	-	345 60	-	-
Bridgewater,	3	92 30	[1] 1,684 75	1,177 05	1,543 15	1,520 40	477 95	-	[3] 480 53	457 78	1,844 84	1	-
Brockton,	1	-	-	-	5,000 00	-	-	-	-	-	5,000 00	-	-

Brookfield, . .	3	-	-	-	545 63	-	-	-	-	-	562 80	-	-
Brookline, . . .	1	-	-	-	5,000 00	-	-	-	-	-	5,000 00	-	-
Burlington, . .	3	1,037 80	2,020 54	2,458 34	316 41	1,812 46	242 75	1,496 05	503 01	1,999 06	399 05	1	-
Cambridge, . .	1	-	-	-	5,000 00	-	-	-	-	-	5,000 00	2	-
Canton, . . .	2	800 00	772 83	1,572 83	2,543 23	4,293 07	1,434 11	440 34	[1] 2,997 60	2,478 42	2,715 96	2	-
Carlisle, . . .	3	2,549 92	460 29	3,010 21	199 17	2,589 09	414 23	2,389 92	625 50	3,015 42	196 96	1	1
Carver, . . .	3	623 71	246 92	870 63	790 28	1,800 46	775 30	1,010 18	667 93	1,678 11	838 47	1	-
Charlton, . . .	3	-	-	-	518 93	-	-	-	-	-	576 27	-	-
Chelmsford, . .	3	74 55	638 82	713 37	1,785 87	2,093 47	746 65	307 60	1,185 21	1,492 81	1,788 36	1	1
Chelsea, . . .	1	-	-	-	5,000 00	-	-	-	-	-	5,000 00	-	2
Clinton, . . .	2	-	-	-	3,661 51	-	-	-	-	-	3,705 84	1	-
Cohasset, . . .	2	131 85	2,447 58	2,089 92	4,417 09	4,423 23	2,421 23	-	[3] 1,990 67	1,597 45	4,078 02	2	-
Concord, . . .	2	366 87	672 17	904 61	3,520 46	4,190 26	831 60	378 76	785 41	1,007 09	3,684 74	4	-
Dana, . . .	3	-	-	-	-	-	-	-	-	-	180 76	-	-
Danvers, . . .	2	805 10	614 28	1,296 53	3,016 55	3,313 44	1,410 23	-	[1,3] 1,967 97	1,214 38	3,099 00	2	2
Dartmouth, . .	3	-	-	-	2,007 73	-	-	-	-	-	2,119 47	1	-
Dedham, . . .	1	-	[3] 3,410 81	2,250 83	5,000 00	-	-	-	-	-	5,000 00	2	-
Deerfield, . . .	3	-	-	-	989 03	-	-	-	3 76	3 76	1,039 83	-	-
Dennis, . . .	3	-	-	-	545 11	-	-	-	-	-	548 99	-	-
Dighton, . . .	3	-	-	-	548 88	-	-	-	-	-	598 63	-	-
Douglas, . . .	3	-	-	-	526 50	-	-	-	-	-	523 43	-	-

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CITIES AND TOWNS.	Class.	1913.			1914.						1915.	SPRAYING OUTFITS IN TOWNS AND CITIES.	
		Re-imburse-ment.	Tools Supplied.	Total Amount received from State.	Required Expendi-ture.	Total Net Expendi-ture.	Private Work.	Re-imburse-ment.	Tools Supplied.	Total Amount received from State.	Required Expendi-ture.	Large.	Small.
Dover,	2	$97 40	$3 20	$99 96	$3,079 54	$2,978 20	$807 48	-	-	-	$3,354 20	1	-
Dracut,	3	576 66	320 54	897 20	1,008 01	1,495 23	1,253 52	$487 22	$849 75	$1,336 97	1,012 66	1	1
Dudley,	3	-	-	-	825 65	-	-	-	-	-	848 20	-	-
Dunstable,	3	733 78	140 24	874 02	171 65	1,407 07	274 81	910 42	[1] 1,188 65	1,774 07	163 98	1	-
Duxbury,	3	309 72	269 04	578 80	1,764 16	2,169 09	1,060 25	199 04	202 35	401 39	1,456 14	1	-
East Bridgewater,	3	-	-	-	945 66	1,701 54	466 25	-	[1] 1,930 39	1,330 39	1,062 14	1	-
Easton,	2	-	[2] 12 50	-	2,792 83	-	-	-	-	-	2,847 19	1	-
Essex,	3	598 78	85 56	684 34	501 86	773 26	458 60	271 40	141 22	412 62	507 19	-	1
Everett,	1	-	-	-	5,000 00	-	-	-	-	-	5,000 00	-	2
Fairhaven,	3	-	-	-	1,631 10	-	-	-	-	-	1,400 44	-	-
Fall River,	1	-	-	-	5,000 00	-	-	-	-	-	5,000 00	1	-
Falmouth,	2-1	-	-	-	4,341 80	-	-	-	-	-	5,000 00	1	-
Fitchburg,	1	-	1 87	1 87	5,000 00	-	-	-	-	-	5,000 00	1	-
Foxborough,	3	-	-	-	1,059 05	-	-	-	-	-	1,093 67	-	1
Framingham,	1	-	-	-	5,000 00	-	-	-	-	-	5,000 00	1	-
Franklin,	3	-	-	-	1,880 97	-	-	-	-	-	1,918 97	-	-
Freetown,	3	-	-	-	407 73	-	-	-	-	-	353 78	-	-
Gardner,	2	-	-	-	4,195 02	-	-	-	-	-	4,538 55	-	1

Georgetown,	3	1,097 63	454 95	1,552 58	509 37	1,515 86	812 90	406 49	[1] 1,909 44	1,715 93	528 67	1	2
Gloucester,	1	829 48	213 83	936 40	5,000 00	5,471 58	1,513 26	–	[3] 526 18	263 09	5,000 00	1	1
Grafton,	3	–	–	–	1,219 66	803 84	150 00	–	–	–	1,297 49	–	1
Great Barrington,	2	–	–	–	2,749 12	–	–	–	–	–	2,770 19	–	–
Greenfield,	2–1	–	2 01	2 01	4,597 02	–	–	–	–	–	5,000 00	1	–
Groton,	3	47 51	535 07	582 58	1,735 29	2,150 40	187 60	300 00	754 94	1,054 94	1,768 95	1	–
Groveland,	3	669 29	193 26	862 55	492 33	1,035 47	485 59	543 14	163 23	706 37	506 16	–	2
Halifax,	3	521 69	12 91	534 60	262 17	923 33	436 09	661 16	22 76	683 92	269 24	–	–
Hamilton,	3	400 00	843 01	1,243 01	2,080 78	2,242 93	976 48	–	774 01	774 01	2,466 01	1	2
Hanover,	3	732 13	374 92	1,107 05	784 20	2,248 57	975 53	1,464 37	1,176 11	2,640 48	842 74	1	–
Hanson,	3	559 73	57 32	617 05	580 61	967 84	628 81	387 23	276 76	663 99	593 40	1	–
Harvard,	3	879 84	532 23	1,112 07	702 06	1,309 97	990 05	7 91	[1] 2,405 56	1,813 47	723 44	1	–
Harwich,	3	–	–	–	627 67	–	–	–	–	–	669 28	–	1
Haverhill,	1	–	24	24	5,000 00	5,695 40	2,041 97	–	–	–	5,000 00	–	–
Hingham,	2	–	[1,3] 2,711 66	1,809 33	3,281 43	3,239 71	2,464 84	–	[3] 1,258 18	1,007 55	3,314 48	2	–
Holbrook,	3	–	–	–	661 97	–	–	–	–	–	680 29	–	2
Holden,	3	217 11	8 40	225 54	725 84	[4] 2,734 76	529 50	2,008 92	299 57	2,308 49	743 11	1	–
Holliston,	3	–	–	–	807 10	–	–	–	58	58	813 98	–	–
Hopedale,	3	–	–	–	2,388 25	–	–	–	–	–	2,682 36	–	–
Hopkinton,	3	587 12	89 23	676 35	727 08	[4] 799 61	173 25	72 53	60 89	133 42	755 66	–	2
Hubbardston,	3	150 33	–	150 33	315 47	538 53	234 65	–	–	–	302 89	–	–

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CITIES AND TOWNS.	Class.	1913.			1914.						1915.	SPRAYING OUTFITS IN TOWNS AND CITIES.	
		Re-imbursement.	Tools Supplied.	Total Amount received from State.	Required Expenditure.	Total Net Expenditure.	Private Work.	Re-imbursement.	Tools Supplied.	Total Amount received from State.	Required Expenditure.	Large.	Small.
Hudson,	3	$199 57	$301 86	$501 43	$1,659 29	$2,258 02	$958 40	-	[1] $1,976 21	$1,376 21	$1,692 78	1	-
Hull,	2	-	-	-	3,258 48	-	-	-	-	-	3,548 58	1	-
Ipswich,	3	456 63	779 22	1,235 85	2,196 02	2,445 27	1,305 30	$249 25	957 38	1,206 63	2,210 78	1	2
Kingston,	3	1,341 43	361 94	1,703 37	671 96	1,804 70	534 98	1,132 74	294 73	1,427 47	672 99	1	-
Lakeville,	3	-	-	-	464 75	-	-	-	-	-	513 60	-	-
Lancaster,	2	-	-	-	2,744 58	-	-	-	-	-	2,765 93	1	-
Lawrence,	1	-	-	-	5,000 00	-	-	-	-	-	5,000 00	1	2
Leicester,	3	-	-	-	1,002 99	-	-	-	-	-	1,021 31	-	-
Lenox,	2	-	-	-	3,585 22	-	-	-	-	-	3,645 75	-	-
Leominster,	1	-	-	-	5,000 00	-	-	-	-	-	5,000 00	-	-
Lexington,	2	1,723 83	2,461 24	3,932 82	3,425 04	[2] 5,131 48	1,385 16	1,098 57	931 09	1,843 44	3,605 05	2	3
Leyden,	3	-	-	-	-	-	-	-	-	-	91 19	-	-
Lincoln,	3	-	[1] 3,727 66	3,127 66	1,751 04	2,072 52	1,656 41	162 48	1,700 38	1,862 86	1,604 02	3	-
Littleton,	3	312 86	[1] 1,964 62	1,677 48	477 62	821 09	93 25	343 47	697 82	1,041 29	493 03	1	-
Lowell,	1	-	-	-	5,000 00	5,848 40	4,598 60	-	386 58	193 29	5,000 00	2	-
Lunenburg,	3	489 26	[1] 1,855 53	1,744 79	557 11	1,219 57	1,731 28	662 46	676 75	1,339 21	602 52	1	-
Lynn,	1	-	-	-	5,000 00	3,712 52	-	-	-	-	5,000 00	2	2
Lynnfield,	3	1,981 77	626 92	2,608 69	507 20	2,357 01	554 55	1,849 81	567 44	2,417 25	525 74	1	1

Malden, . . .	1	-	-	-	5,000 00	-	-	-	-	-	5,000 00	1	3
Manchester, . .	1	-	-	-	5,000 00	-	-	-	-	-	5,000 00	-	-
Mansfield, . . .	3	-	-	-	1,768 66	-	-	-	-	-	1,342 09	1	-
Marblehead, . .	2	-	-	-	3,764 06	-	-	-	-	-	4,444 38	1	1
Marion, . . .	3	-	-	-	2,066 85	-	-	-	-	-	2,350 14	-	-
Marlborough, . .	2	141 49	854 12	824 79	4,289 75	[2] 5,063 65	2,295 13	-	[1,3] 2,486 28	1,629 03	4,402 46	2	-
Marshfield, . .	3	659 00	798 24	1,457 24	1,129 52	1,929 27	972 75	799 75	871 93	1,671 68	1,045 51	1	-
Mashpee, . . .	3	1,328 06	286 74	1,614 80	100 03	878 03	47 00	778 00	253 03	1,031 03	106 40	-	-
Mattapoisett, . .	3	-	-	-	740 39	-	-	-	-	-	758 23	-	1
Maynard, . . .	3	-	[1] 1,542 04	942 04	1,637 82	1,587 88	304 70	-	-	-	1,652 82	-	1
Medfield, . . .	3	-	-	-	726 81	-	-	-	-	-	1,022 12	-	1
Medford, . . .	1	-	[4] 1,040 94	-	5,000 00	4,019 88	-	-	[4] 640 40	-	5,000 00	-	-
Medway, . . .	3	-	-	-	688 73	-	-	-	-	-	716 36	-	1
Melrose, . . .	1	-	-	-	5,000 00	-	-	-	-	-	5,000 00	2	1
Mendon, . . .	3	-	-	-	277 51	-	-	-	-	-	287 03	-	-
Merrimac, . . .	3	776 80	215 10	991 90	513 78	1,465 74	368 63	951 96	216 59	1,168 55	537 47	-	2
Methuen, . . .	2	159 77	907 65	885 89	3,360 68	3,726 52	2,426 59	65 66	[3] 1,135 05	973 70	3,754 86	3	2
Middleborough, .	3	770 00	681 09	1,451 09	1,993 88	2,799 43	1,329 90	805 55	836 47	1,642 02	1,986 31	1	-
Middleton, . .	3	1,048 93	301 09	1,350 02	364 61	1,204 97	216 56	840 36	226 83	1,067 19	371 73	-	2
Milford, . . .	2	-	-	-	4,029 46	-	-	-	-	-	4,061 36	-	-
Millbury, . . .	3	-	-	-	1,186 66	-	-	-	-	-	1,285 32	-	-

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Cities and Towns.	Class.	1913.			1914.						1915.	Spraying Outfits in Towns and Cities.	
		Re-imbursement.	Tools Supplied.	Total Amount received from State.	Required Expenditure.	Total Net Expenditure.	Private Work.	Re-imbursement.	Tools Supplied.	Total Amount received from State.	Required Expenditure.	Large.	Small.
Millis, ...	3	-	-	-	$547 23	-	-	-	-	-	$558 17	1	-
Milton, ...	1	-	[1] $4,302 76	$1,911 61	5,000 00	$1,092 13	-	-	[2] $18 50	-	5,000 00	3	-
Nahant, ...	2	-	-	-	3,627 12	-	-	-	-	-	3,474 48	-	1
Nantucket, . . .	3	-	-	-	1,736 82	-	-	-	40	$0 40	1,836 92	-	-
Natick, ...	2	-	[2] 87 80	-	3,536 28	3,419 96	$2,408 82	-	[2] 92 15	-	3,647 16	3	-
Needham, ...	2	$355 99	-	355 99	3,110 46	-	-	-	-	-	3,365 53	1	-
New Bedford, . .	1	-	-	-	5,000 00	-	-	-	-	-	5,000 00	-	-
New Braintree, . .	3	-	-	-	169 27	-	-	-	-	-	164 95	-	-
New Salem, . . .	3	-	-	-	157 03	-	-	-	-	-	162 70	-	-
Newbury, ...	3	1,370 11	581 79	1,951 90	604 09	1,653 14	785 28	$1,049 05	531 58	1,580 63	635 69	1	2
Newburyport, . .	1	-	-	-	5,000 00	-	-	-	-	-	5,000 00	1	1
Newton, ...	1	2,000 00	9,849 28	6,924 64	5,000 00	12,986 61	19,684 39	1,598 54	4,789 55	3,993 31	5,000 00	7	-
Norfolk, ...	3	130 71	111 58	242 29	479 03	825 93	189 45	346 90	111 96	458 86	465 54	-	1
North Andover, .	3	98 10	538 20	636 30	2,229 00	2,093 66	1,374 16	-	[1] 775 57	640 23	2,301 33	1	2
North Attleborough,	2	-	-	-	3,828 41	-	-	-	-	-	3,876 10	1	-
North Brookfield, .	3	-	-	-	765 03	-	-	-	-	-	800 17	-	-
North Reading, .	3	2,278 38	1,344 45	3,622 83	367 70	1,953 37	981 59	1,585 67	1,017 92	2,603 59	393 09	1	-
Northborough, . .	3	78 37	[3] 1,492 33	970 70	738 19	1,542 54	244 35	904 35	448 73	1,353 08	770 71	1	-

Northbridge,	3	-	-	-	2,210 49	-	-	-	-	-	2,232 67	-	-
Norton,	3	-	-	-	675 10	[4] 86 00	-	-	-	-	666 60	-	1
Norwell,	3	588 73	1,021 27	1,610 00	462 94	867 84	1,090 69	404 90	1,231 53	1,636 43	475 65	1	-
Norwood,	1–2	-	-	-	5,000 00	-	-	-	-	-	4,449 52	1	-
Oak Bluffs,	3	-	-	-	765 61	-	-	-	-	-	779 00	-	-
Oakham,	3	-	-	-	151 92	-	-	-	-	-	147 11	-	-
Orange,	3	-	-	-	1,622 09	-	-	-	-	-	1,605 70	-	-
Orleans,	3	-	-	-	1,478 52	-	-	-	-	-	1,534 24	-	-
Oxford,	3	-	-	-	825 79	-	-	-	-	-	836 65	-	-
Palmer,	3	-	-	-	2,115 60	-	-	-	-	-	2,103 39	-	-
Paxton,	3	-	-	-	158 87	-	-	-	-	-	163 18	-	-
Peabody,	1	-	-	-	5,000 00	-	-	-	-	-	5,000 00	1	1
Pembroke,	3	1,455 97	63 60	1,519 57	434 81	1,687 18	446 75	652 37	[3] 1,920 17	1,972 51	466 61	1	-
Pepperell,	3	1,004 74	422 93	1,427 67	926 75	1,864 28	527 12	937 53	571 79	1,509 32	943 42	1	-
Petersham,	3	-	-	-	444 69	-	-	-	-	-	460 97	-	-
Phillipston,	3	-	-	-	116 14	-	-	-	-	-	124 70	-	-
Plainville,	3	-	-	-	414 68	790 77	59 22	200 00	150 97	350 97	417 16	1	-
Plymouth,	1	-	-	-	5,000 00	-	-	-	-	-	5,000 00	2	-
Plympton,	3	1,503 90	134 08	1,637 98	174 25	1,963 84	168 12	1,789 59	284 34	2,073 93	182 82	-	1
Princeton,	3	-	1 80	1 80	596 48	[4] 7,511 84	691 86	6,915 36	682 96	7,598 32	594 05	-	-
Provincetown,	3	-	-	-	944 17	-	-	-	-	-	969 35	-	-

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[1] Town paid part of the amount for supplies.

[2] Town paid full cost of supplies.

[3] Received sprayer from State, town paying one-half the cost, $600.

[4] Work financed by State.

CITIES AND TOWNS.	Class.	1913.			1914.						1915.	SPRAYING OUTFITS IN TOWNS AND CITIES.	
		Re-imbursement.	Tools Supplied.	Total Amount received from State.	Required Expenditure.	Total Net Expenditure.	Private Work.	Re-imbursement.	Tools Supplied.	Total Amount received from State.	Required Expenditure.	Large.	Small.
Quincy,	1	-	[1]$1,146 64	$904 77	$5,000 00	$4,949 96	$966 33	-	[2]$1,133 92	-	$5,000 00	2	-
Randolph,	3	-	-	-	1,129 50	-	-	-	-	-	1,153 50	-	1
Raynham,	3	-	[1]61 23	23 81	365 10	[3]487 73	130 77	$122 63	47 45	$170 08	313 30	-	1
Reading,	2	$133 33	1,464 88	1,305 23	2,788 71	3,291 58	2,201 25	32 28	1,850 11	1,512 37	3,007 58	2	1
Rehoboth,	3	-	-	-	411 04	-	-	-	-	-	328 34	-	1
Revere,	1	-	-	-	5,000 00	[3]57 25	-	-	-	-	5,000 00	1	1
Rochester,	3	-	[2]29 35	-	383 62	-	-	-	-	-	415 98	-	1
Rockland,	3	-	-	-	2,091 52	-	-	-	-	-	2,171 19	-	1
Rockport,	3	313 72	-	313 72	1,563 59	1,653 35	1,135 91	-	-	-	1,609 42	1	3
Rowley,	3	220 07	246 50	466 57	919 07	596 16	890 46	-	[1]608 57	285 66	869 73	1	1
Royalston,	3	-	[2]3 90	-	288 25	106 98	193 10	-	-	-	299 39	-	-
Rutland,	3	-	-	-	342 78	-	-	-	-	-	366 93	-	-
Salem,	1	-	-	-	5,000 00	-	-	-	-	-	5,000 00	1	1
Salisbury,	3	898 91	304 22	1,203 13	571 86	1,379 22	480 47	207 36	[4]1,874 54	1,481 90	590 16	1	2
Sandwich,	3	295 81	139 99	435 80	520 32	739 94	90 50	219 62	156 93	376 55	570 50	-	-
Saugus,	2	1,798 32	763 79	2,409 35	2,670 32	3,991 11	2,224 13	851 16	[1]1,027 34	1,673 03	2,777 34	2	1

Scituate, . . .	3	3,045 05	[5] 4,511 70	6,356 75	2,218 48	4,967 58	1,500 00	2,749 10	1,063 61	3,812 71	2,279 01	2	-
Seekonk, . . .	3	-	-	-	659 45	-	-	-	-	-	637 08	-	1
Sharon, . . .	3	-	-	-	1,487 41	-	-	-	-	-	1,484 78	-	1
Sherborn, . . .	3	147 88	333 19	481 07	892 70	830 60	1,087 00	-	[1] 326 74	264 64	957 37	1	-
Shirley, . . .	3	40 83	313 83	354 66	505 28	665 34	141 90	160 06	405 15	565 21	524 04	1	-
Shrewsbury, . .	3	-	[2] 38 81	-	1,001 17	1,048 80	493 59	-	38 61	38 61	1,090 37	1	-
Somerset, . . .	3	-	-	-	659 68	-	-	-	-	-	615 49	-	1
Somerville, . .	1	-	-	-	5,000 00	-	-	-	-	-	5,000 00	-	-
Southborough, . .	3	-	[4] 1,459 70	859 70	856 04	1,264 13	849 23	348 94	238 46	587 40	926 47	2	-
Spencer, . . .	3	-	-	-	1,408 47	-	-	-	-	-	1,457 87	-	-
Springfield, . .	1	-	-	-	5,000 00	-	-	-	-	-	5,000 00	-	-
Sterling, . . .	3	-	[1] 336 75	331 17	499 84	1,425 67	243 26	846 24	426 59	1,272 83	508 38	1	-
Stockbridge, . .	3	-	-	-	1,703 57	-	-	-	-	-	1,991 67	-	-
Stoneham, . .	3	-	[1] 688 48	641 36	2,140 83	2,315 11	1,586 78	69 99	675 69	746 68	2,362 14	1	2
Stoughton, . .	3	-	-	-	1,610 80	1,721 22	853 00	110 42	866 06	976 48	1,666 30	1	-
Stow, . . .	3	779 85	403 49	1,183 24	448 54	1,483 34	386 24	200 00	[4] 2,248 60	1,848 60	462 68	1	-
Sturbridge, . .	3	-	-	-	372 80	-	-	-	-	-	376 69	-	-
Sudbury, . . .	3	1,178 21	455 90	1,634 11	558 91	1,939 18	516 21	956 77	746 22	1,702 99	599 43	1	-
Sutton, . . .	3	-	-	-	611 92	-	-	-	-	-	583 98	-	-
Swampscott, . .	1	-	-	-	5,000 00	-	-	-	-	-	5,000 00	1	1

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[1] Town paid part of the amount for supplies.

[2] Town paid full cost of supplies.

[3] Work financed by State.

[4] Received sprayer from State, town paying one-half the cost, $600.

[5] Received two sprayers from State, town paying one-half the cost, $1,200.

CITIES AND TOWNS.	Class.	1913.			1914.						1915.	SPRAYING OUTFITS IN TOWNS AND CITIES.	
		Re-imbursement.	Tools Supplied.	Total Amount received from State.	Required Expenditure.	Total Net Expenditure.	Private Work.	Re-imbursement.	Tools Supplied.	Total Amount received from State.	Required Expenditure.	Large.	Small.
Swansea,	3	-	-	-	$706 68	-	-	-	-	-	$499 77	-	1
Taunton,	1	-	-	-	5,000 00	-	-	-	-	-	5,000 00	1	-
Templeton,	3	-	$1 69	$1 69	734 77	[1] $2,117 90	$745 70	$1,383 13	$243 73	$1,626 86	789 90	-	-
Tewksbury,	3	$799 98	598 20	1,398 18	645 83	1,797 53	342 81	1,151 70	1,018 45	2,170 15	676 85	1	1
Topsfield,	3	337 55	194 85	532 40	1,427 43	[1] 1,340 03	668 14	-	294 91	[2] 207 51	1,628 20	-	1
Townsend,	3	1,128 69	286 69	1,415 38	546 91	1,148 77	552 30	601 86	552 84	1,154 70	567 99	1	-
Truro,	3	-	-	-	163 22	-	-	-	-	-	169 23	-	-
Tyngsborough,	3	737 49	[3] 2,228 41	2,365 90	269 96	1,880 29	728 73	1,610 33	1,021 85	2,632 18	283 11	-	-
Upton,	3	-	-	-	504 47	-	-	-	-	-	507 46	-	-
Uxbridge,	3	-	-	-	1,503 98	-	-	-	-	-	1,608 55	-	-
Wakefield,	2	-	[4] 829 68	-	4,602 40	-	-	-	[4] 827 18	-	4,766 51	2	1
Walpole,	3	-	-	-	2,762 19	-	-	-	-	-	2,864 54	1	-
Waltham,	1	259 23	1,779 41	1,148 93	5,000 00	7,817 54	5,539 54	681 62	1,454 30	1,408 77	5,000 00	2	1
Wareham,	3	-	-	-	2,218 48	-	-	-	-	-	1,918 00	1	-
Warren,	3	-	-	-	979 44	-	-	-	-	-	1,024 81	-	-
Warwick,	3	-	-	-	182 51	-	-	-	-	-	187 68	-	-

Watertown,	1	-	-	-	5,000 00	-	-	-	-	-	5,000 00	1	-
Wayland,	3	243 33	766 15	1,009 48	1,214 60	1,480 04	1,296 26	265 44	922 70	1,188 14	1,205 84	1	-
Webster,	2	-	-	-	2,851 88	-	-	-	-	-	3,376 96	-	-
Wellesley,	1	-	[4] 3 50	-	5,000 00	5,467 12	1,588 76	-	-	-	5,000 00	3	-
Wellfleet,	3	-	-	-	352 84	-	-	-	-	-	336 92	-	1
Wendell,	3	-	-	-	-	-	-	-	-	-	205 15	-	-
Wenham,	3	-	[3] 1,589 19	989 19	1,064 16	1,605 88	600 95	275 25	571 71	846 96	1,321 30	1	1
West Boylston,	3	-	-	-	380 42	366 25	270 07	-	77	77	397 72	-	-
West Bridgewater,	3	567 85	277 02	844 87	621 62	1,463 88	631 63	842 26	366 55	1,208 81	656 62	1	-
West Newbury,	3	952 20	318 45	1,270 65	436 80	986 27	464 96	549 47	215 42	764 89	430 32	1	2
Westborough,	3	-	[3] 1,850 17	1,250 17	1,309 46	1,686 99	466 48	377 53	138 61	516 14	1,333 45	1	-
Westford,	3	983 55	1,045 41	2,028 96	882 21	1,498 03	776 75	615 82	912 82	1,528 64	902 64	1	1
Westminster,	3	610 09	102 56	712 65	396 36	2,367 41	218 60	1,971 05	130 62	2,101 67	390 89	-	1
Weston,	2	982 80	[3] 3,700 90	3,583 52	3,248 27	5,805 99	1,920 30	-	1,539 63	1,231 70	3,516 77	5	-
Westport,	3	-	-	-	912 68	-	-	-	-	-	813 32	-	-
Westwood,	3	-	-	-	1,640 03	-	-	-	-	-	1,788 42	1	-
Weymouth,	2	-	[2] 2,360 53	1,774 63	4,587 23	3,982 14	1,667 25	-	[2] 1,873 06	1,014 38	4,808 27	2	-
Whately,	3	-	-	-	-	-	-	-	5 26	-	291 84	-	-
Whitman,	3	-	-	-	2,229 69	-	-	-	-	-	2,256 00	1	-
Wilbraham,	3	-	-	-	489 82	-	-	-	-	-	566 35	-	-
Wilmington,	3	1,686 44	[3] 2,586 52	3,672 96	726 89	2,023 46	1,315 74	1,296 57	812 67	2,109 24	792 29	1	1

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[1] Work financed by State.

[2] Town paid part of the amount for supplies.

[3] Received sprayer from State, town paying one-half the cost, $600.

[4] Town paid full cost of supplies.

CITIES AND TOWNS.	Class.	1913.			1914.						1915.	SPRAYING OUTFITS IN TOWNS AND CITIES.	
		Re-imbursement.	Tools Supplied.	Total Amount received from State.	Required Expenditure.	Total Net Expenditure.	Private Work.	Re-imbursement.	Tools Supplied.	Total Amount received from State.	Required Expenditure.	Large.	Small.
Winchendon, . . .	3	$147 82	$179 17	$326 99	$1,720 71	$2,623 28	$750 44	$902 57	$325 73	$1,228 30	$1,737 45	1	-
Winchester, . . .	1	-	-	-	5,000 00	-	-	-	-	-	5,000 00	1	1
Winthrop, ...	1	-	-	-	5,000 00	-	-	-	-	-	5,000 00	2	-
Woburn, ...	2	3,628 61	1,418 76	4,763 62	4,828 12	8,515 98	1,344 69	2,776 85	867 21	3,470 62	4,933 61	1	1
Worcester, ...	1	-	-	-	5,000 00	10,195 53	13,547 13	-	[1,2]3,024 06	1,512 03	5,000 00	3	-
Wrentham, . . .	3	-	-	-	587 68	-	-	-	-	-	620 34	-	1
Yarmouth, . . .	3	-	-	-	1,020 00	-	-	-	-	-	1,048 39	-	-

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[1] Received sprayer from State, town paying one-half the cost, $600.

[2] Town paid part of the amount for supplies.

CONCLUSION.

Each year heretofore the annual report of the State Forester has concluded with the following heading: "Summary of Recommendations." This is omitted this year, as we are not asking for any new legislation other than is covered in the general estimates that have been sent to the State Auditor.

I am pleased to say that with the legislation of the last General Court, the general program outlined by this department for securing the fundamentals of a State forest policy, which has extended over a period of eight years, has been covered.

We are, therefore, now in a position to exert our best energies in accomplishing results. Let us all have a part in this splendid work.

Respectfully submitted,

F. W. RANE,
State Forester.

FINANCIAL RETURNS

AND

ANALYSIS OF PREMIUMS AND GRATUITIES

OF THE

INCORPORATED SOCIETIES,

WITH

MEMBERSHIP AND INSTITUTES,

FOR THE YEAR 1914.

Financial Returns of the Incorporated Societies

	SOCIETIES.	When incorporated.	Amount originally raised by Contribution. (R. L. 124, Sects. 1 and 3.)	Amount now held invested as Capital Stock. (R. L. 124, Sects. 3 and 12.)	Total Assets.	Real Estate.	Notes.	Stocks and Bonds.
1	Amesbury and Salisbury (Agricultural and Horticultural),	1881	$1,002 32	[1] $8,221 69	$8,221 69	$7,716 69	–	–
2	Barnstable County,	1844	1,740 00	[2] 11,651 10	12,512 17	9,000 00	–	–
3	Blackstone Valley,	1884	3,000 00	[4] 8,700 00	9,115 78	8,700 00	–	–
4	Deerfield Valley,	1871	4,094 01	[1] 9,750 00	10,089 57	9,500 00	–	–
5	Eastern Hampden,	1856	3,000 00	[1] 20,350 00	21,100 25	20,050 00	–	–
6	Essex,	1818	4,527 20	[5] 4,490 00	5,547 05	–	[6] $4,400 00	$90 00
7	Franklin County,	1850	1,000 00	[7] 17,025 00	17,026 78	15,875 00	–	1,000 00
8	Hampshire,	1814	3,255 26	[1] 6,125 00	6,125 00	6,075 00	–	–
9	Hampshire, Franklin and Hampden,	1818	8,141 29	[1] 29,810 00	30,463 96	29,210 00	–	–
10	Highland,	1859	3,262 00	[1] 3,120 00	3,307 21	3,000 00	–	–
11	Hillside,	1883	3,113 32	[1] 5,615 00	5,615 00	5,250 00	–	–
12	Hingham (Agricultural and Horticultural),	1867	17,406 15	[8] 4,109 40	4,109 40	2,500 00	–	–
13	Hoosac Valley,	1860	2,006 00	[1] 15,000 00	15,162 72	14,700 00	–	–
14	Housatonic,	1848	6,335 33	[9] 29,281 29	29,281 29	26,000 00	–	500 00
15	Lenox Horticultural,	1910	2,103 33	[10] 2,789 17	3,003 61	–	–	–
16	Marshfield (Agricultural and Horticultural),	1867	3,755 33	[1] 16,700 00	16,700 00	16,000 00	–	–
17	Martha's Vineyard,	1859	4,552 17	[11] 4,673 13	4,737 43	2,750 00	80 00	–
18	Massachusetts Horticultural,	1829	525 00	[12] 836,475 10	849,230 61	518,564 63	–	263,300 00
19	Massachusetts Society for Promoting Agriculture,[14]	1792	–	–	–	–	–	–
20	Middlesex North,	1855	3,000 00	[15] 6,928 80	6,939 41	–	3,504 80	–
21	Middlesex South,	1854	3,000 00	[1] 15,200 00	15,369 52	15,000 00	–	–
22	Nantucket,	1856	3,500 00	[4] 3,200 00	3,693 89	3,200 00	–	–
23	Oxford,	1888	4,400 00	[8] 11,672 22	11,672 22	11,000 00	–	–
24	Plymouth County,	1819	800 00	[10] 2,231 19	2,231 62	–	–	–
25	Quannapowitt (Association),	1909	1,000 00	[1] 36,727 83	37,034 78	36,127 83	–	–
26	Union (Agricultural and Horticultural),	1867	4,447 23	[1] 9,000 00	9,000 00	8,000 00	–	–
27	West Taunton,	1913	100 29	[10] 1,183 45	1,401 29	–	–	–
28	Weymouth (Agricultural and Industrial),	1891	10,270 00	[1] 11,450 00	15,685 11	15,000 00	–	–
29	Worcester,	1818	7,730 00	[8] 98,934 62	98,934 62	85,000 00	–	–
30	Worcester East,	1890	2,296 23	[1] 16,491 30	16,615 36	15,534 00	–	–
31	Worcester North (Agricultural and Driving Association),	1913	3,602 63	[4] 46,246 94	47,313 16	46,246 94	–	–
32	Worcester Northwest (Agricultural and Mechanical Association),	1867	3,400 00	[1] 13,300 00	13,300 00	13,000 00	–	–
33	Worcester South,	1855	3,127 40	[1] 21,950 00	22,195 41	20,600 00	–	–
34	Worcester County West,	1851	3,175 00	[1] 8,500 00	8,678 51	8,000 00	–	–
			$126,667 49	$1,422,402 23	$1,361,414 42	$971,600 09	$7,984 80	$264,890 00

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[1] Invested in real estate, crockery, tables, etc.

[2] Invested in real estate, trust funds, crockery, tables, etc.

[3] Trust funds.

[4] Invested in real estate.

[5] Invested in a mortgage, stocks, crockery, tables, etc.

[6] Mortgage.

[7] Invested in real estate, stocks, crockery, tables, etc.

[8] Invested in real estate, bank funds, crockery, tables, etc.

FOR THE ELEVEN MONTHS ENDING NOV. 30, 1914.

Bank Funds.	Crockery, Tables, etc.	Bills due and unpaid.	Cash on Hand.	Total Liabilities.	Premiums due and unpaid.	Outstanding Bills.	Mortgages.	Notes.	Total Receipts.	
–	$505 00	–	–	$1,547 44	–	$30 25	$1,500 00	$17 19	$2,864 01	1
[3]$2,126 10	525 00	–	$861 07	2,744 52	$269 25	75 00	–	2,400 00	12,264 38	2
–	–	–	415 78	2,500 00	–	–	2,500 00	–	3,769 23	3
–	250 00	$103 75	235 82	500 00	–	–	–	500 00	2,987 53	4
–	300 00	–	750 25	7,363 35	–	149 39	5,513 96	1,700 00	7,315 28	5
–	1,000 00	–	57 05	2,000 00	–	–	–	2,000 00	4,025 21	6
–	150 00	–	1 78	2,892 00	–	42 00	–	2,850 00	6,972 49	7
–	50 00	–	–	2,750 00	–	–	750 00	2,000 00	3,279 66	8
600 00	–	–	653 96	2,000 00	–	–	2,000 00	–	14,791 83	9
–	120 00	–	187 21	–	–	–	–	–	1,333 94	10
–	365 00	–	–	–	–	–	–	–	2,399 65	11
709 40	900 00	–	–	–	–	–	–	–	1,173 39	12
–	300 00	–	162 72	11,150 80	–	150 80	9,000 00	2,000 00	7,735 76	13
1,071 80	425 00	–	1,284 49	2,846 56	–	50 00	–	2,796 56	14,935 45	14
2,364 17	425 00	–	214 44	–	–	–	–	–	1,429 54	15
–	700 00	–	–	1,699 28	13 65	185 63	–	1,500 00	11,901 90	16
1,643 13	200 00	3 00	61 30	50 00	–	50 00	–	–	1,448 56	17
–	[13]54,610 47	–	12,755 51	–	–	–	–	–	23,204 27	18
–	–	–	–	–	–	–	–	–	–	19
3,424 00	–	–	10 61	–	–	–	–	–	1,218 08	20
–	200 00	90 00	79 52	15,413 76	971 70	442 06	12,000 00	2,000 00	5,954 13	21
–	–	–	493 89	–	–	–	–	–	2,254 06	22
39 62	632 60	–	–	3,000 00	–	–	2,500 00	500 00	4,514 48	23
2,192 19	39 00	–	43	–	–	–	–	–	675 62	24
–	600 00	80 00	226 95	16,867 34	–	867 34	13,000 00	3,000 00	10,816 76	25
–	1,000 00	–	–	972 88	–	72 88	–	900 00	2,908 87	26
618 12	565 33	–	217 84	–	–	–	–	–	954 63	27
–	450 00	–	235 11	3,956 77	–	256 77	3,500 00	200 00	4,849 77	28
11,286 81	1,938 36	–	709 45	2,500 00	–	–	–	2,500 00	39,753 76	29
–	957 30	–	124 06	–	–	–	–	–	7,379 06	30
–	–	911 15	155 07	42,000 00	–	–	12,000 00	30,000 00	41,705 05	31
–	300 00	–	–	5,282 96	–	732 96	3,050 00	1,500 00	9,278 09	32
–	1,350 00	–	245 41	3,190 92	657 05	333 87	–	2,200 00	6,075 82	33
–	500 00	50 00	128 51	1,336 74	–	1,336 74	–	–	4,683 95	34
$26,075 34	$69,358 06	$1,237 90	$20,268 23	$134,565 32	$1,911 65	$4,775 69	$67,313 96	$60,563 75	$266,854 21	

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[9] Invested in real estate, stocks, bank funds, crockery, tables, etc.

[10] Invested in bank funds, crockery, tables, etc.

[11] Invested in real estate, notes, bank funds, crockery, tables, etc.

[12] Invested in real estate, library, stocks, bonds, crockery, tables, etc.

[13] Includes library valued at $45,110.47.

[14] Represented on the Board by special enactment, and makes no returns.

[15] Invested in notes and bank funds.

Financial Returns of the Incorporated Societies for

	SOCIETIES.	Bounty.	Income from Notes and Bank Funds.	Income from Stocks and Bonds.	New Members.	Donations.	Entry Fees.	Gate Receipts.
1	Amesbury and Salisbury (Agricultural and Horticultural), . .	$926 75	–	–	–	$111 94	–	$1,055 60
2	Barnstable County, ...	948 50	$36 00	–	$45 00	41 00	$523 40	4,731 25
3	Blackstone Valley, ...	792 35	–	–	56 00	9 80	62 25	1,406 29
4	Deerfield Valley, ...	924 45	–	–	6 00	–	200 00	1,470 10
5	Eastern Hampden, ...	996 50	–	–	15 00	–	465 00	4,065 35
6	Essex, ...	976 95	[1] 359 65	–	30 00	85 00	131 50	1,291 69
7	Franklin County, ...	1,000 00	–	$50 00	–	20 00	125 00	4,050 00
8	Hampshire, ...	941 00	–	–	55 00	85 00	378 75	729 50
9	Hampshire, Franklin and Hampden, ...	1,000 00	–	–	67 00	–	440 00	8,794 45
10	Highland, ...	862 35	–	–	36 00	75	46 30	249 30
11	Hillside, ...	972 05	–	–	10 00	25 00	33 00	814 30
12	Hingham (Agricultural and Horticultural), ...	732 55	28 39	–	130 00	23 70	–	–
13	Hoosac Valley, ...	659 45	2,555 00	–	–	–	–	3,157 75
14	Housatonic, ...	1,000 00	41 60	1,626 00	360 00	10 00	1,495 00	5,051 35
15	Lenox Horticultural, ...	840 73	91 76	–	4 00	202 00	–	291 05
16	Marshfield (Agricultural and Horticultural), ...	961 90	92 80	–	90 00	–	2,120 00	4,697 00
17	Martha's Vineyard, ...	864 20	68 19	–	18 00	–	–	259 47
18	Massachusetts Horticultural, . .	1,000 00	–	11,898 87	3,370 00	54 50	–	1,503 50
19	Massachusetts Society for Promoting Agriculture,[2]	–	–	–	–	–	–	–
20	Middlesex North, ...	860 05	294 28	–	62 00	1 75	–	–
21	Middlesex South, ...	1,000 00	–	–	15 00	17 25	1,003 58	2,904 50
22	Nantucket, ...	835 50	–	–	18 00	3 75	120 00	856 70
23	Oxford, ...	905 60	–	–	10 00	–	415 49	1,650 51
24	Plymouth County, ...	506 55	94 16	–	2 00	8 50	–	–
25	Quannapowitt (Association), . .	912 20	–	–	154 00	–	–	4,278 25
26	Union (Agricultural and Horticultural), ...	866 38	–	–	38 00	21 00	255 50	739 35
27	West Taunton, ...	215 85	–	–	185 00	80 50	13 70	286 35
28	Weymouth (Agricultural and Industrial), ...	1,000 00	–	–	–	22 40	360 75	2,382 25
29	Worcester, ...	972 25	580 66	–	90 00	837 68	3,432 76	18,711 00
30	Worcester East, ...	1,000 00	–	–	27 00	922 00	63 10	2,851 95
31	Worcester North (Agricultural and Driving Association), ...	898 35	–	–	1,400 00	574 00	1,344 60	4,188 65
32	Worcester Northwest (Agricultural and Mechanical Association), .	1,000 00	–	–	15 00	–	631 75	4,373 25
33	Worcester South, ...	876 10	–	–	39 00	–	359 20	2,976 25
34	Worcester County West, ...	939 90	–	–	15 00	–	445 00	2,159 00
		$29,188 46	$4,242 49	$13,574 87	$6,362 00	$3,157 52	$14,465 63	$91,975 96

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[1] Includes income from mortgage of $352.58.

[2] Represented on the Board by special enactment, and makes no returns.

THE ELEVEN MONTHS ENDING NOV. 30, 1914 — *Concluded.*

Grand Stand Receipts.	Concessions and Rentals.	All Other Sources.	Total Expenditures.	Premiums and Gratuities paid.	New Buildings and Repairs.	Current Running Expenses.	Farmers' Institutes.	Interest.	All Other Expenses.	
-	$411 00	$358 72	$2,881 20	$936 40	-	$510 00	$11 40	$87 92	$1,335 48	1
$1,940 25	1,152 30	2,846 68	11,403 31	1,001 90	$926 31	6,836 53	18 57	132 00	2,488 00	2
1,088 45	154 49	199 60	4,200 10	1,258 95	172 92	2,602 36	-	125 00	40 87	3
148 50	223 72	14 76	2,975 07	1,669 85	310 24	747 84	6 00	30 00	211 14	4
636 75	826 00	311 68	6,565 03	1,403 03	383 98	4,355 74	-	281 77	140 51	5
-	200 50	949 92	4,340 33	1,279 75	1,477 16	375 72	11 60	142 33	1,053 77	6
579 04	670 00	478 45	8,351 00	3,007 05	264 26	1,085 52	-	100 73	3,893 44	7
60 50	81 25	948 66	3,281 81	895 75	320 25	-538 31	-	135 00	1,392 50	8
1,554 05	1,995 86	940 47	14,137 87	3,951 10	1,866 58	3,533 48	39 15	130 55	4,617 01	9
-	46 00	93 24	1,336 42	977 40	-	353 94	5 08	-	-	10
49 50	182 00	313 80	2,475 88	1,207 30	25 00	1,230 00	1 50	12 08	-	11
-	-	258 75	1,295 98	922 90	12 90	360 18	-	-	-	12
299 25	568 95	495 36	7,573 04	846 50	185 05	2,128 00	1 50	676 00	3,735 99	13
2,027 00	3,239 25	85 25	15,305 32	7,314 00	699 35	5,885 41	-	-	1,406 56	14
-	-	-	1,606 85	1,101 50	-	414 59	-	91 76	-	15
727 60	892 40	2,320 20	15,951 29	1,197 25	3,036 17	8,995 35	34 50	121 10	2,566 92	16
-	180 50	58 20	1,428 63	917 87	-	330 00	-	-	180 76	17
-	5,377 40	-	23,515 06	6,432 54	907 71	16,174 81	-	-	-	18
-	-	-	-	-	-	-	-	-	-	19
-	-	-	1,041 66	764 50	-	174 86	102 30	-	-	20
203 25	556 35	254 20	5,874 61	2,034 50	264 99	1,860 40	-	[3] 1,355 04	359 68	21
53 75	214 81	151 55	1,778 47	896 00	115 32	242 90	43 00	-	481 25	22
432 25	271 00	829 63	4,474 86	1,825 00	120 00	1,209 86	3 00	155 00	1,162 00	23
-	-	64 41	581 03	495 40	-	79 63	6 00	-	-	24
834 50	715 00	3,922 81	10,638 40	1,389 80	1,867 88	5,791 08	22 10	460 00	1,107 54	25
65 25	204 15	719 24	2,948 24	1,542 73	424 22	840 66	35 00	45 50	60 13	26
-	4 00	169 23	736 79	366 55	-	-	-	-	370 24	27
129 00	641 75	313 62	4,825 49	881 60	248 25	2,807 09	-	218 75	669 80	28
3,906 30	5,208 30	6,014 81	46,896 96	11,580 25	8,585 14	25,731 76	30 00	52 19	917 62	29
910 80	605 50	998 71	7,255 00	1,712 50	219 20	5,312 50	10 80	-	-	30
627 25	915 05	[4] 31,757 15	41,550 78	1,858 45	7,080 38	449 38	7 80	1,468 51	30,686 26	31
671 45	752 00	1,834 64	9,278 09	2,028 80	320 00	2,856 81	-	286 48	3,786 00	32
791 25	577 70	456 32	8,216 40	2,048 37	1,802 67	3,502 72	14 00	-	848 64	33
448 10	234 25	443 70	5,575 33	2,079 65	822 20	1,968 70	2 25	-	702 53	34
$18,184 04	$27,101 48	$58,603 76	$280,296 30	$67,825 14	$32,458 13	$109,286 13	$405 55	$6,107 71	$64,214 64	

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[3] Includes $669.50 paid on principal of note.

[4] Includes $30,000 received from sale of notes.

Analysis of General Premiums and Gratuities offered, Months ending Nov. 30,

	SOCIETIES.	Total Amount offered in Premiums.	Total Amount awarded in Premiums and Gratuities.	Total Amount paid in Premiums and Gratuities.
1	Amesbury and Salisbury (Agricultural and Horticultural),	$1,815 55	$821 60	$821 60
2	Barnstable County,	2,131 75	1,148 15	887 40
3	Blackstone Valley,	2,079 25	1,120 50	1,054 70
4	Deerfield Valley,	1,264 50	1,004 10	1,004 10
5	Eastern Hampden,	1,786 55	1,197 05	1,161 68
6	Essex,	2,190 00	1,087 00	1,087 00
7	Franklin County,	3,457 70	1,847 20	1,847 20
8	Hampshire,	1,930 75	764 75	764 75
9	Hampshire, Franklin and Hampden,	2,690 75	1,886 25	1,886 25
10	Highland,	996 25	720 45	720 45
11	Hillside,	1,030 50	974 55	974 55
12	Hingham (Agricultural and Horticultural),	1,268 85	742 20	742 20
13	Hoosac Valley,	1,727 25	627 75	627 75
14	Housatonic,	3,491 50	3,429 25	3,429 25
15	Lenox Horticultural,	1,290 00	984 50	984 50
16	Marshfield (Agricultural and Horticultural),	1,497 50	1,035 65	1,025 05
17	Martha's Vineyard,	810 50	811 57	811 57
18	Massachusetts Horticultural,	8,692 00	6,199 50	6,199 50
19	Massachusetts Society for Promoting Agriculture,[1]	–	–	–
20	Middlesex North,	925 00	586 15	586 15
21	Middlesex South,	2,041 55	1,560 45	1,560 45
22	Nantucket,	1,240 75	843 00	843 00
23	Oxford,	1,529 20	856 00	856 00
24	Plymouth County,	471 00	434 70	434 70
25	Quannapowitt (Association),	1,389 50	1,003 75	1,003 75
26	Union (Agricultural and Horticultural),	1,350 85	887 71	861 58
27	West Taunton,	390 95	343 80	343 80
28	Weymouth (Agricultural and Industrial),	1,463 75	772 60	772 60
29	Worcester,	10,058 50	6,752 25	6,752 25
30	Worcester East,	2,450 25	1,454 75	1,454 75
31	Worcester North (Agricultural and Driving Association),	2,767 25	1,548 60	1,549 60
32	Worcester Northwest (Agricultural and Mechanical Association),	2,485 75	1,812 30	1,812 30
33	Worcester South,	2,222 75	1,415 17	1,389 10
34	Worcester County West,	1,909 05	1,012 10	1,012 10
		$72,847 25	$47,685 35	$47,261 63

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[1] Represented on the Board by special enactment, and makes no returns.

AWARDED AND PAID, AND INSTITUTES HELD, IN THE ELEVEN
1914; ALSO MEMBERSHIP.

Amount offered under Head of Farms, etc.	Amount awarded under Head of Farms, etc.	Amount paid under Head of Farms, etc.	Amount offered under Head of Farm and Pet Stock.	Amount awarded under Head of Farm and Pet Stock.	Amount paid under Head of Farm and Pet Stock.	Amount offered under Head of Field and Garden Crops.	Amount awarded under Head of Field and Garden Crops.	Amount paid under Head of Field and Garden Crops.	
–	–	–	$1,220 00	$424 00	$424 00	–	–	–	1
$94 00	–	–	1,166 00	414 75	258 25	$93 00	–	–	2
114 00	$74 00	$74 00	1,578 00	784 00	734 20	–	–	–	3
180 00	180 00	180 00	901 00	664 90	664 90	–	–	–	4
255 00	159 00	159 00	1,032 00	627 75	596 75	–	–	–	5
100 00	26 00	26 00	1,223 75	554 50	554 50	163 00	–	–	6
–	–	–	2,669 00	1,171 25	1,171 25	–	–	–	7
28 00	–	–	1,550 00	491 00	491 00	–	–	–	8
195 00	193 00	193 00	2,042 00	1,377 90	1,377 90	–	–	–	9
–	–	–	745 25	518 25	518 25	5 00	$3 50	$3 50	10
113 50	115 50	115 50	575 50	546 85	546 85	41 50	41 50	41 50	11
113 75	26 00	26 00	–	–	–	154 50	93 00	93 00	12
–	–	–	1,294 00	296 00	296 00	–	–	–	13
–	–	–	1,893 00	1,910 75	1,910 75	277 00	268 00	268 00	14
50 00	–	–	–	–	–	–	–	–	15
100 00	–	–	765 00	555 30	552 10	85 50	–	–	16
9 00	–	–	487 75	412 30	412 30	–	–	–	17
–	–	–	–	–	–	–	–	–	18
–	–	–	–	–	–	–	–	–	19
–	–	–	478 00	232 25	232 25	–	–	–	20
56 00	46 00	46 00	1,395 00	1,041 00	1,041 00	–	–	–	21
138 00	38 00	38 00	597 25	478 75	478 75	138 00	56 00	56 00	22
60 00	29 00	29 00	1,167 50	614 50	614 50	–	–	–	23
30 00	16 00	16 00	181 00	197 50	197 50	–	–	–	24
40 00	38 00	38 00	526 50	208 50	208 50	–	–	–	25
110 00	108 00	108 00	966 00	500 00	493 25	–	–	–	26
–	–	–	119 50	84 85	84 85	–	–	–	27
–	–	–	1,078 50	542 55	542 55	–	–	–	28
–	–	–	9,666 25	5,923 25	5,923 25	–	–	–	29
27 00	17 00	17 00	1,672 00	902 00	902 00	–	–	–	30
–	–	–	2,306 00	1,282 90	1,282 90	–	–	–	31
–	–	–	1,608 00	1,130 60	1,130 60	–	–	–	32
176 00	139 00	139 00	1,523 00	896 50	888 43	–	–	–	33
108 00	47 00	47 00	1,474 00	756 00	756 00	–	–	–	34
$2,097 25	$1,251 50	$1,251 50	$43,900 75	$25,540 65	$25,285 33	$957 50	$462 00	$462 00	

Analysis of General Premiums and Gratuities offered,
Months ending Nov. 30,

	SOCIETIES.	Amount offered under Head of Farm and Garden Products.	Amount awarded under Head of Farm and Garden Products.	Amount paid under Head of Farm and Garden Products.	Amount offered under Head of Dairy Products.	Amount awarded under Head of Dairy Products.	Amount paid under Head of Dairy Products.
1	Amesbury and Salisbury (Agricultural and Horticultural),	$284 05	$202 10	$202 10	$3 25	$2 00	$2 00
2	Barnstable County,	425 00	370 35	297 10	10 00	11 00	8 00
3	Blackstone Valley,	214 75	158 50	149 50	10 00	10 00	9 00
4	Deerfield Valley,	73 50	64 20	64 20	12 00	6 00	6 00
5	Eastern Hampden,	290 50	240 25	237 38	32 00	27 00	27 00
6	Essex,	390 00	262 50	262 50	14 00	–	–
7	Franklin County	328 45	263 30	263 30	22 00	11 00	11 00
8	Hampshire,	171 00	138 75	138 75	6 00	4 00	4 00
9	Hampshire, Franklin and Hampden,	225 75	154 35	154 35	36 00	10 00	10 00
10	Highland,	103 95	85 35	85 35	5 00	4 50	4 50
11	Hillside,	110 00	98 50	98 50	4 00	4 00	4 00
12	Hingham (Agricultural and Horticultural),	822 35	478 80	478 80	3 50	2 00	2 00
13	Hoosac Valley,	131 50	88 50	88 50	19 00	4 25	4 25
14	Housatonic,	400 75	367 00	367 00	40 00	40 00	40 00
15	Lenox Horticultural,	1,240 00	984 50	984 50	–	–	–
16	Marshfield (Agricultural and Horticultural),	240 00	208 35	202 70	12 00	5 00	5 00
17	Martha's Vineyard,	143 00	163 97	163 97	10 00	11 00	11 00
18	Massachusetts Horticultural,	8,692 00	6,199 50	6,199 50	–	–	–
19	Massachusetts Society for Promoting Agriculture,[1]	–	–	–	–	–	–
20	Middlesex North,	252 50	222 65	222 65	–	–	–
21	Middlesex South,	410 35	326 50	326 50	–	–	–
22	Nantucket,	198 00	92 50	92 50	16 00	–	–
23	Oxford,	125 25	89 50	89 50	12 00	5 00	5 00
24	Plymouth County,	143 50	102 90	102 90	–	–	–
25	Quannapowitt (Association),	233 50	167 75	167 75	–	–	–
26	Union (Agricultural and Horticultural),	114 30	145 32	134 48	13 25	8 75	8 75
27	West Taunton,	231 25	215 40	215 40	75	50	50
28	Weymouth (Agricultural and Industrial),	222 25	115 90	115 90	5 50	–	–
29	Worcester,	684 00	533 00	533 00	332 00	15 00	15 00
30	Worcester East,	352 75	299 25	299 25	21 00	8 00	8 00
31	Worcester North (Agricultural and Driving Association),	351 75	196 75	196 75	–	–	–
32	Worcester Northwest (Agricultural and Mechanical Association),	521 50	438 90	438 90	11 00	5 00	5 00
33	Worcester South,	194 75	102 07	102 07	23 00	23 00	20 00
34	Worcester County West,	183 75	131 00	131 00	14 00	5 00	5 00
		$18,505 95	$13,708 16	$13,606 55	$687 25	$222 00	$215 00

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[1] Represented on the Board by special enactment, and makes no returns.

AWARDED AND PAID, AND INSTITUTES HELD, IN THE ELEVEN
1914; ALSO MEMBERSHIP — *Continued.*

Amount offered under Head of Domestic Manufactures.	Amount awarded under Head of Domestic Manufactures.	Amount paid under Head of Domestic Manufactures.	Amount offered under Head of Agricultural Implements.	Amount awarded under Head of Agricultural Implements.	Amount paid under Head of Agricultural Implements.	Amount offered under Head of Grange Exhibits.	Amount awarded under Head of Grange Exhibits.	Amount paid under Head of Grange Exhibits.	
$172 25	$153 50	$153 50	–	–	–	$90 00	$40 00	$40 00	1
343 75	352 05	324 05	–	–	–	–	–	–	2
127 50	74 00	71 00	–	–	–	35 00	20 00	17 00	3
93 00	86 70	86 70	–	–	–	–	–	–	4
104 05	88 05	86 55	–	–	–	55 00	55 00	55 00	5
93 25	81 00	81 00	$31 00	$3 00	$3 00	175 00	160 00	160 00	6
97 25	107 65	107 65	–	–	–	50 00	60 00	60 00	7
65 75	51 00	51 00	–	–	–	110 00	80 00	80 00	8
167 00	136 00	136 00	–	–	–	25 00	15 00	15 00	9
137 05	108 85	108 85	–	–	–	–	–	–	10
161 00	143 20	143 20	–	–	–	–	–	–	11
174 75	142 40	142 40	–	–	–	–	–	–	12
276 75	239 00	239 00	6 00	–	–	–	–	–	13
700 75	673 50	673 50	–	–	–	130 00	130 00	130 00	14
–	–	–	–	–	–	–	–	–	15
250 00	222 00	220 25	–	–	–	45 00	45 00	45 00	16
160 75	224 30	224 30	–	–	–	–	–	–	17
–	–	–	–	–	–	–	–	–	18
–	–	–	–	–	–	–	–	–	19
94 50	66 25	66 25	–	–	–	–	–	–	20
95 20	74 95	74 95	–	–	–	85 00	72 00	72 00	21
113 25	177 75	177 75	–	–	–	–	–	–	22
114 45	78 00	78 00	–	–	–	50 00	40 00	40 00	23
66 50	68 30	68 30	–	–	–	50 00	50 00	50 00	24
109 50	109 50	109 50	–	–	–	630 00	480 00	480 00	25
147 30	125 64	117 10	–	–	–	–	–	–	26
39 45	43 05	43 05	–	–	–	–	–	–	27
157 50	114 15	114 15	–	–	–	–	–	–	28
126 25	81 00	81 00	–	–	–	250 00	200 00	200 00	29
367 50	218 50	218 50	10 00	10 00	10 00	–	–	–	30
109 50	68 95	68 95	–	–	–	–	–	–	31
160 25	87 80	87 80	–	–	–	185 00	150 00	150 00	32
186 00	134 60	130 60	–	–	–	120 00	120 00	120 00	33
119 30	63 10	63 10	10 00	10 00	10 00	–	–	–	34
$5,131 30	$4,394 74	$4,347 95	$57 00	$23 00	$23 00	$2,085 00	$1,717 00	$1,714 00	

ANALYSIS OF GENERAL PREMIUMS AND GRATUITIES OFFERED, MONTHS ENDING NOV. 30,

	SOCIETIES.	Amount offered for All Other Objects, Strictly Agricultural.	Amount awarded for All Other Objects, Strictly Agricultural.	Amount paid for All Other Objects, Strictly Agricultural.	Amount received in Entry Fees for Trotting.	Amount paid for Trotting.	Amount paid for Sports and Games.
1	Amesbury and Salisbury (Agricultural and Horticultural),	$46 00	–	–	–	–	$450 00
2	Barnstable County,	–	–	–	$475 00	$1,532 80	699 70
3	Blackstone Valley,	–	–	–	10 00	350 00	299 50
4	Deerfield Valley,	5 00	$2 30	$2 30	200 00	550 00	15 00
5	Eastern Hampden,	18 00	–	–	465 00	1,700 00	217 00
6	Essex,	–	–	–	–	–	31 00
7	Franklin County,	291 00	234 00	234 00	125 00	970 00	–
8	Hampshire,	–	–	–	378 75	850 00	17 50
9	Hampshire, Franklin and Hampden,	–	–	–	440 00	1,765 00	–
10	Highland,	–	–	–	19 00	70 00	11 00
11	Hillside,	–	–	–	5 00	25 00	6 00
12	Hingham (Agricultural and Horticultural),	–	–	–	–	–	–
13	Hoosac Valley,	–	–	–	360 00	1,860 00	325 00
14	Housatonic,	50 00	40 00	40 00	1,495 00	3,445 00	–
15	Lenox Horticultural,	–	–	–	–	–	–
16	Marshfield (Agricultural and Horticultural),	–	–	–	2,120 00	3,590 00	75 00
17	Martha's Vineyard,	–	–	–	–	–	71 95
18	Massachusetts Horticultural,	–	–	–	–	–	–
19	Massachusetts Society for Promoting Agriculture,[1]	–	–	–	–	–	–
20	Middlesex North,	100 00	65 00	65 00	–	–	–
21	Middlesex South,	–	–	–	570 00	1,200 00	15 00
22	Nantucket,	22 00	–	–	120 00	130 00	–
23	Oxford,	–	–	–	372 50	800 00	–
24	Plymouth County,	–	–	–	–	–	–
25	Quannapowitt (Association),	–	–	–	992 50	2,091 25	374 00
26	Union (Agricultural and Horticultural),	–	–	–	213 00	565 00	22 00
27	West Taunton,	–	–	–	–	–	–
28	Weymouth (Agricultural and Industrial),	–	–	–	320 00	960 00	191 50
29	Worcester,	–	–	–	1,764 00	4,615 50	783 00
30	Worcester East,	–	–	–	985 00	910 00	–
31	Worcester North (Agricultural and Driving Association),	–	–	–	1,000 00	2,760 00	451 64
32	Worcester Northwest (Agricultural and Mechanical Association),	–	–	–	547 50	1,350 00	–
33	Worcester South,	–	–	–	214 00	1,082 50	–
34	Worcester County West,	–	–	–	445 00	900 00	50 20
		$532 00	$341 30	$341 30	$13,636 25	$34,072 05	$4,105 99

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[1] Represented on the Board by special enactment, and makes no returns.

[2] Not reported.

AWARDED AND PAID, AND INSTITUTES HELD, IN THE ELEVEN
1914; ALSO MEMBERSHIP — *Concluded.*

Amount paid for Other Attractions.	Number of Persons receiving Premiums.	Number of Persons receiving Gratuities.	Number of Cities and Towns where Premiums were paid.	Amount paid to Parties outside the State.	Number of Male Members.	Number of Female Members.	Total Membership.	Number of Institute Sessions held.	Average Attendance per Session.	
–	271	–	16	$38 50	199	29	228	4	78	1
$690 00	180	177	13	–	186	156	342	4	65	2
394 65	168	3	11	12 00	281	243	524	2	146	3
–	200	–	16	9 65	973	263	1,236	6	108	4
1,176 00	219	–	28	90 00	299	174	473	3	66	5
–	188	21	25	–	741	16	757	6	119	6
800 00	500	125	23	234 00	1,400	100	1,500	4	84	7
525 00	187	5	17	2 00	300	175	475	0	0	8
2,117 50	641	–	33	137 00	628	226	854	4	206	9
–	220	–	19	–	239	135	374	3	60	10
–	276	–	24	7 00	638	41	679	2	140	11
–	308	289	5	–	353	130	483	2	195	12
75 00	250	–	6	55 10	377	15	392	0	0	13
1,571 56	634	29	16	588 00	1,882	84	1,966	2	158	14
–	55	–	6	–	122	16	138	2	80	15
950 00	190	172	33	1 30	511	292	803	2	24	16
75 00	77	176	6	–	50	99	149	3	67	17
–	243	171	74	117 00	744	190	934	16	123	18
–	–	–	–	–	–	–	–	–	–	19
–	227	31	10	50	561	237	798	6	200	20
305 00	160	6	30	118 00	–	[2] –	500	1	160	21
–	286	162	1	–	224	435	659	1	30	22
500 00	227	6	15	–	326	260	586	2	28	23
–	192	121	8	–	610	512	1,122	5	94	24
[3] 999 00	346	–	22	–	164	–	164	4	144	25
–	176	58	20	32 00	689	876	1,565	3	203	26
47 00	160	75	6	–	54	11	65	4	83	27
808 10	341	22	14	–	481	11	492	3	57	28
4,999 97	333	8	62	821 75	1,554	247	1,801	4	84	29
710 45	331	54	34	26 75	111	85	196	2	58	30
1,486 75	244	56	22	1 50	82	1	83	4	176	31
1,207 90	185	–	27	22 50	432	220	652	0	0	32
1,057 20	136	63	23	300 00	537	772	1,309	3	39	33
627 33	[2] –	[2] –	35	–	330	67	397	6	54	34
$21,123 41	8,151	1,830	700	$2,614 55	16,078	6,118	22,696	113	104	

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[3] Includes $227.50 awarded school children, and babies in the "Better Babies Health Contest."

Analysis of Premiums offered, awarded and paid to Children

	SOCIETIES.	Total Amount offered in Premiums.	Total Amount awarded in Premiums.	Total Amount paid in Premiums.
1	Amesbury and Salisbury (Agricultural and Horticultural),	$233 25	$114 80	$114 80
2	Barnstable County,	345 50	123 00	114 50
3	Blackstone Valley,	284 50	204 25	204 25
4	Deerfield Valley,	159 00	92 75	92 75
5	Eastern Hampden,	357 10	241 35	241 35
6	Essex,	391 25	148 00	148 00
7	Franklin County,	316 75	189 85	189 85
8	Hampshire,	205 00	133 00	133 00
9	Hampshire, Franklin and Hampden,	249 75	181 75	181 75
10	Highland,	229 75	175 95	175 95
11	Hillside,	232 00	195 00	195 00
12	Hingham (Agricultural and Horticultural),	331 45	160 20	160 20
13	Hoosac Valley,	342 25	210 50	210 50
14	Housatonic,	443 25	274 75	274 75
15	Lenox Horticultural,	172 50	117 00	117 00
16	Marshfield (Agricultural and Horticultural),	308 00	175 25	172 20
17	Martha's Vineyard,	214 25	99 65	99 65
18	Massachusetts Horticultural,	239 00	233 04	233 04
19	Massachusetts Society for Promoting Agriculture,[1]	–	–	–
20	Middlesex North,	228 25	178 85	178 85
21	Middlesex South,	300 00	245 75	245 75
22	Nantucket,	266 75	53 00	53 00
23	Oxford,	239 35	169 00	169 00
24	Plymouth County,	55 50	42 60	42 60
25	Quannapowitt (Association),	200 00	160 55	160 55
26	Union (Agricultural and Horticultural),	169 30	115 95	115 95
27	West Taunton,	33 00	22 75	22 75
28	Weymouth (Agricultural and Industrial),	230 95	109 00	109 00
29	Worcester,	249 00	212 50	212 50
30	Worcester East,	358 75	257 75	257 75
31	Worcester North (Agricultural and Driving Association),	113 15	111 15	111 15
32	Worcester Northwest (Agricultural and Mechanical Association,)	341 75	216 50	216 50
33	Worcester South,	187 60	129 50	129 50
34	Worcester County West,	296 25	167 55	167 55
		$8,324 15	$5,262 49	$5,250 94

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[1] Represented on the Board by special enactment, and makes no returns.

AND YOUTHS IN THE ELEVEN MONTHS ENDING NOV. 30, 1914.

Amount offered under Head of Farms, etc.	Amount awarded under Head of Farms, etc.	Amount paid under Head of Farms, etc.	Amount offered under Head of Farm and Pet Stock.	Amount awarded under Head of Farm and Pet Stock.	Amount paid under Head of Farm and Pet Stock.	Amount offered under Head of Field and Garden Crops.	Amount awarded under Head of Field and Garden Crops.	Amount paid under Head of Field and Garden Crops.	
-	-	-	$87 75	$35 50	$35 50	-	-	-	1
-	-	-	109 00	36 00	29 00	$30 00	-	-	2
$10 00	$20 00	$20 00	48 00	95 50	95 50	-	-	-	3
-	-	-	30 25	21 50	21 50	-	-	-	4
-	-	-	123 50	41 25	41 25	-	-	-	5
46 00	-	-	107 00	35 50	35 50	22 00	-	-	6
-	-	-	132 00	68 50	68 50	-	-	-	7
23 00	4 00	4 00	55 50	44 25	44 25	-	-	-	8
-	-	-	82 25	30 00	30 00	-	-	-	9
-	-	-	62 75	55 75	55 75	-	-	-	10
-	-	-	88 00	69 75	69 75	15 00	$10 00	$10 00	11
29 00	19 00	19 00	-	-	-	36 00	20 00	20 00	12
57 00	51 00	51 00	17 00	23 50	23 50	-	-	-	13
115 00	79 00	79 00	124 00	47 50	47 50	42 00	17 00	17 00	14
96 50	93 00	93 00	-	-	-	-	-	-	15
-	-	-	25 00	11 35	10 85	-	-	-	16
-	-	-	45 00	34 50	34 50	20 00	10 00	10 00	17
-	-	-	-	-	-	-	-	-	18
-	-	-	-	-	-	-	-	-	19
-	-	-	48 50	48 25	48 25	18 25	-	-	20
-	-	-	40 00	39 50	39 50	-	-	-	21
14 00	16 00	16 00	63 25	18 50	18 50	-	-	-	22
12 00	11 00	11 00	119 25	83 00	83 00	-	-	-	23
3 00	1 50	1 50	15 00	14 45	14 45	-	-	-	24
-	-	-	200 00	13 05	13 05	-	-	-	25
-	-	-	39 00	17 25	17 25	-	-	-	26
-	-	-	-	-	-	-	-	-	27
-	-	-	80 00	57 35	57 35	-	-	-	28
-	-	-	151 00	137 00	137 00	-	-	-	29
35 00	25 00	25 00	71 25	55 25	55 25	-	-	-	30
-	-	-	39 00	39 00	39 00	-	-	-	31
42 00	38 00	38 00	80 00	70 45	70 45	-	-	-	32
12 00	12 00	12 00	71 50	61 50	61 50	-	-	-	33
12 00	5 00	5 00	136 75	62 25	62 25	-	-	-	34
$506 50	$374 50	$374 50	$2,291 50	$1,367 15	$1,359 65	$183 25	$57 00	$57 00	

Analysis of Premiums offered, awarded and paid to Children and

	SOCIETIES.	Amount offered under Head of Farm and Garden Products.	Amount awarded under Head of Farm and Garden Products.	Amount paid under Head of Farm and Garden Products.
1	Amesbury and Salisbury (Agricultural and Horticultural),	$81 25	$33 30	$33 30
2	Barnstable County,	108 50	37 00	35 50
3	Blackstone Valley,	116 25	55 25	55 25
4	Deerfield Valley,	58 75	39 25	39 25
5	Eastern Hampden,	131 00	109 65	109 65
6	Essex,	130 00	84 75	84 75
7	Franklin County,	106 50	81 85	81 85
8	Hampshire,	87 00	79 50	79 50
9	Hampshire, Franklin and Hampden,	95 75	68 00	68 00
10	Highland,	64 75	52 75	52 75
11	Hillside,	45 00	37 75	37 75
12	Hingham (Agricultural and Horticultural),	109 00	76 35	76 35
13	Hoosac Valley,	102 00	68 50	68 50
14	Housatonic,	54 50	44 00	44 00
15	Lenox Horticultural,	51 50	11 00	11 00
16	Marshfield (Agricultural and Horticultural),	200 00	96 60	94 55
17	Martha's Vineyard,	96 50	42 00	42 00
18	Massachusetts Horticultural,	239 00	233 04	233 04
19	Massachusetts Society for Promoting Agriculture,[1]	–	–	–
20	Middlesex North,	98 25	70 00	70 00
21	Middlesex South,	112 50	88 25	88 25
22	Nantucket,	71 75	11 75	11 75
23	Oxford,	51 50	31 50	31 50
24	Plymouth County,	15 00	9 30	9 30
25	Quannapowitt (Association),	200 00	104 50	104 50
26	Union (Agricultural and Horticultural),	77 25	52 15	52 15
27	West Taunton,	26 25	16 00	16 00
28	Weymouth (Agricultural and Industrial),	61 55	20 40	20 40
29	Worcester,	91 00	71 00	71 00
30	Worcester East,	76 25	71 60	71 60
31	Worcester North (Agricultural and Driving Association),	45 00	43 00	43 00
32	Worcester Northwest (Agricultural and Mechanical Association),	75 75	43 15	43 15
33	Worcester South,	49 00	29 75	29 75
34	Worcester County West,	112 75	79 25	79 25
		$3,041 05	$1,992 14	$1,988 59

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[1] Represented on the Board by special enactment, and makes no returns.

YOUTHS IN THE ELEVEN MONTHS ENDING NOV. 30, 1914 — *Concluded.*

Amount offered under Head of Dairy Products.	Amount awarded under Head of Dairy Products.	Amount paid under Head of Dairy Products.	Amount offered under Head of Domestic Manufactures.	Amount awarded under Head of Domestic Manufactures.	Amount paid under Head of Domestic Manufactures.	Amount offered for All Other Objects, strictly Agricultural.	Amount awarded for All Other Objects, strictly Agricultural.	Amount paid for All Other Objects, strictly Agricultural.	
-	-	-	$64 25	$46 00	$46 00	-	-	-	1
-	-	-	98 00	50 00	50 00	-	-	-	2
-	-	-	110 25	33 50	33 50	-	-	-	3
-	-	-	22 00	12 00	12 00	$48 00	$20 00	$20 00	4
-	-	-	67 10	44 95	44 95	45 50	45 50	45 50	5
-	-	-	84 00	27 75	27 75	2 25	-	-	6
-	-	-	78 25	39 50	39 50	-	-	-	7
-	-	-	39 50	5 25	5 25	-	-	-	8
-	-	-	59 75	65 75	65 75	12 00	18 00	18 00	9
-	-	-	102 25	67 45	67 45	-	-	-	10
-	-	-	84 00	77 50	77 50	-	-	-	11
-	-	-	77 45	44 85	44 85	80 00	-	-	12
-	-	-	166 25	67 50	67 50	-	-	-	13
-	-	-	107 75	87 25	87 25	-	-	-	14
-	-	-	24 50	13 00	13 00	-	-	-	15
-	-	-	83 00	67 30	66 80	-	-	-	16
-	-	-	52 75	13 15	13 15	-	-	-	17
-	-	-	-	-	-	-	-	-	18
-	-	-	-	-	-	-	-	-	19
-	-	-	25 00	26 10	26 10	38 25	34 50	34 50	20
-	-	-	147 50	118 00	118 00	-	-	-	21
-	-	-	93 25	6 75	6 75	-	-	-	22
-	-	-	43 10	30 00	30 00	13 50	13 50	13 50	23
-	-	-	22 50	17 35	17 35	-	-	-	24
-	-	-	20 00	43 00	43 00	-	-	-	25
$5 75	$4 50	$4 50	47 30	42 05	42 05	-	-	-	26
-	-	-	6 75	6 75	6 75	-	-	-	27
-	-	-	89 40	31 25	31 25	-	-	-	28
-	-	-	7 00	4 50	4 50	-	-	-	29
-	-	-	176 25	105 90	105 90	-	-	-	30
-	-	-	29 15	29 15	29 15	-	-	-	31
-	-	-	144 00	64 90	64 90	-	-	-	32
-	-	-	55 10	26 25	26 25	-	-	-	33
-	-	-	34 75	21 05	21 05	-	-	-	34
$5 75	$4 50	$4 50	$2,262 10	$1,335 70	$1,335 20	$239 50	$131 50	$131 50	

DIRECTORY

OF THE

AGRICULTURAL AND SIMILAR ORGANIZATIONS OF MASSACHUSETTS

1915

STATE BOARD OF AGRICULTURE, 1915.

Members ex Officio.

His Excellency DAVID I. WALSH.
His Honor GRAFTON D. CUSHING.
Hon. ALBERT P. LANGTRY, *Secretary of the Commonwealth.*
KENYON L. BUTTERFIELD, *President, Massachusetts Agricultural College.*
LESTER H. HOWARD, *Acting Commissioner of Animal Industry.*
F. WILLIAM RANE, *State Forester.*
WILFRID WHEELER, *Secretary of the Board.*

Members appointed by the Governor and Council.

	Term expires
HENRY M. HOWARD of Newton (P. O. West Newton),	1915
CHARLES M. GARDNER of Westfield,	1916
FRANK P. NEWKIRK of Easthampton,	1917

Members chosen by the Incorporated Societies.

Amesbury and Salisbury (Agricultural and Horticultural),	A. WILLIS BARTLETT of Salisbury,	1918
Barnstable County,	JOHN BURSLEY of Barnstable (P. O. West Barnstable),	1916
Blackstone Valley,	JACOB A. WILLIAMS of Northbridge,	1918
Deerfield Valley,	DAVID T. BARNARD of Shelburne,	1917
Eastern Hampden,	O. E. BRADWAY of Monson,	1918
Essex,	FREDERICK A. RUSSELL of Methuen,	1917
Franklin County,	GEORGE E. TAYLOR, Jr., of Shelburne,	1916
Hampshire,	F. E. FARRAR of Amherst,	1916
Hampshire, Franklin and Hampden,	CLARENCE E. HODGKINS of Northampton,	1918
Highland,	JOHN T. BRYAN of Middlefield (P. O. Chester, R. F. D.),	1917
Hillside,	HAROLD S. PACKARD of Plainfield,	1917
Hingham (Agricultural and Horticultural),	U. S. BATES of Hingham,	1918
Hoosac Valley,	NATHAN B. FLOOD of North Adams,	1918
Housatonic,	CHARLES W. FREEHAN of Great Barrington,	1918
Lenox Horticultural,	ALFRED H. WINGETT of Lenox,	1917
Marshfield (Agricultural and Horticultural),	WALTER H. FAUNCE of Kingston,	1918
Martha's Vineyard,	JAMES F. ADAMS of West Tisbury,	1916
Massachusetts Horticultural,	EDWARD B. WILDER of Dorchester,	1918
Massachusetts Society for Promoting Agriculture,	N. I. BOWDITCH of Framingham,	1918
Middlesex North,	GEORGE W. TRULL of Tewksbury (P. O. Lowell, R. F. D.),	1917
Middlesex South,	JOHN J. ERWIN of Wayland,	1917
Nantucket,	HERBERT G. WORTH of Nantucket,	1918
Oxford,	WALTER A. LOVETT of Oxford,	1916
Plymouth County,	ERNEST LEACH of Bridgewater,	1917
Quannapowitt,	CALVERT H. PLAYDON, D.V.S., of Reading,	1916
Spencer (Farmers' and Mechanics' Association),	EDWARD WARREN of Leicester,	1916
Union (Agricultural and Horticultural),	HENRY K. HERRICK of Blandford,	1916
West Taunton,	CHARLES I. KING of Taunton,	1917
Weymouth (Agricultural and Horticultural),	THERON L. TIRRELL of Weymouth (P. O. South Weymouth),	1918
Worcester,	EDWARD A. WATERS of West Boylston,	1917
Worcester East,	ARTHUR C. HAWKINS of Lancaster,	1918
Worcester North (Agricultural and Driving Association),	HENRY D. CLARK, D.V.S., of Fitchburg,	1918
Worcester Northwest (Agricultural and Mechanical),	ALBERT ELLSWORTH of Athol,	1916
Worcester South,	WILLIAM E. PATRICK of Warren,	1916
Worcester County West,	JAMES A. RICE of Barre,	1917

ORGANIZATION OF THE BOARD.

OFFICERS.

President,	His Excellency DAVID I. WALSH, *ex officio.*
First Vice-President,	JOHN BURSLEY of Barnstable.
Second Vice-President,	FREDERICK A. RUSSELL of Methuen.
Secretary,	WILFRID WHEELER of Concord.

Office, Room 136, State House, Boston.

COMMITTEES.

Executive Committee.

Messrs. John Bursley of Barnstable.
O. E. Bradway of Monson.
George W. Trull of Tewksbury.
William E. Patrick of Warren.
Charles M. Gardner of Westfield.
Frederick A. Russell of Methuen.
Henry M. Howard of West Newton.
Walter A. Lovett of Oxford.
George E. Taylor, Jr., of Shelburne.

Committee on Agricultural Societies.

Messrs. O. E. Bradway of Monson.
Albert Ellsworth of Athol.
Theron L. Tirrell of Weymouth.
Jacob A. Williams of Northbridge.
Herbert G. Worth of Nantucket.

Committee on Domestic Animals, Poultry and Dairy Products.

Messrs. William E. Patrick of Warren.
Herbert G. Worth of Nantucket.
Henry K. Herrick of Blandford.
Edward A. Waters of West Boylston.
Henry D. Clark of Fitchburg.

Committee on the Massachusetts Agricultural College and the Massachusetts Agricultural Experiment Station.

Messrs. John Bursley of Barnstable.
Frank P. Newkirk of Easthampton.
William E. Patrick of Warren.
John J. Erwin of Wayland.
Charles W. Freehan of Great Barrington.

Committee on Orcharding and Fruit Growing.

Messrs. Frederick A. Russell of Methuen.
Alfred H. Wingett of Lenox.
Edward Warren of Leicester.
Edward B. Wilder of Dorchester.
Arthur C. Hawkins of Lancaster.

Committee on Grasses and Forage Crops.

Messrs. George E. Taylor, Jr., of Shelburne.
U. S. Bates of Hingham.
N. I. Bowditch of Framingham.
Calvert H. Playdon of Reading.
Harold S. Packard of Plainfield.

Committee on Markets and Transportation.

Messrs. Charles M. Gardner of Westfield.
F. E. Farrar of Amherst.
A. Willis Bartlett of Salisbury.
Charles I. King of Taunton.
David T. Barnard of Shelburne.
Nathan B. Flood of North Adams

Committee on Farm Tools and Machinery.

Messrs. Walter A. Lovett of Oxford.
Jacob A. Williams of Northbridge.
James A. Rice of Barre.
Ernest Leach of Bridgewater.
Clarence E. Hodgkins of Northampton.

Committee on Institutes and Public Meetings.

Messrs. George W. Trull of Tewksbury.
James F. Adams of West Tisbury.
Kenyon L. Butterfield of Amherst.
George E. Taylor, Jr., of Shelburne.
Clarence E. Hodgkins of Northampton.

Committee on Irrigation and Drainage.

Messrs. Henry M. Howard of West Newton.
John T. Bryan of Middlefield.
John J. Erwin of Wayland.
F. E. Farrar of Amherst.
Walter H. Faunce of Kingston.

The Secretary is a member, *ex officio*, of the above committees.

DAIRY BUREAU.

Messrs. Charles M. Gardner of Westfield, 1914; O. E. Bradway of Monson, 1915; George W. Trull of Tewksbury, 1916.

Executive Officer,	Wilfrid Wheeler of Concord.
General Agent,	P. M. Harwood of Barre.

Office, Room 136, State House.

STATE NURSERY INSPECTOR.

Henry T. Fernald, Ph.D., of Amherst.

STATE ORNITHOLOGIST.

Edward Howe Forbush of Westborough.

STATE INSPECTOR OF APIARIES.

Burton N. Gates, Ph.D., of Amherst.

SPECIALISTS.

Chemist,	J. B. Lindsey,	Amherst.
Entomologist,	C. H. Fernald,	Amherst.
Botanist,	George E. Stone,	Amherst.
Pomologist,	F. C. Sears,	Amherst.
Veterinarian,	James B. Paige,	Amherst.
Engineer,	William Wheeler,	Concord.
Agricultural Club Work,	William R. Hart,	Amherst.

MASSACHUSETTS AGRICULTURAL COLLEGE.

Location, Amherst, Hampshire County.

The Corporation.

Members of the Corporation.

	Term expires
Nathaniel I. Bowditch of Framingham,	1915
William Wheeler of Concord,	1915
Arthur G. Pollard of Lowell,	1916
Charles A. Gleason of New Braintree,	1916
Frank Gerrett of Greenfield,	1917
Harold L. Frost of Arlington,	1917
Charles H. Preston of Danvers,	1918
Frank A. Hosmer of Amherst,	1918
Davis R. Dewey of Cambridge,	1919
George P. O'Donnell of Northampton,	1919
William H. Bowker of Concord,	1920
George H. Ellis of West Newton,	1920
Elmer D. Howe of Marlborough,	1921
Edmund Mortimer of Grafton,	1921

Members ex Officio.

His Excellency Governor David I. Walsh.

President of the Corporation.

Kenyon L. Butterfield,	*President of the College.*
David Snedden,	*State Commissioner of Education.*
Wilfrid Wheeler,	*Secretary of the State Board of Agriculture.*

Officers of the Corporation.

His Excellency Governor David I. Walsh of Boston,	*President.*
Charles A. Gleason of New Braintree,	*Vice-President.*
Wilfrid Wheeler of Concord,	*Secretary.*
Fred C. Kenney of Amherst,	*Treasurer.*
Charles A. Gleason of New Braintree,	*Auditor.*

Examining Committee of Overseers from the State Board of Agriculture.

John Bursley of Barnstable.
Frank P. Newkirk of Easthampton.
William E. Patrick of Warren.
John J. Erwin of Wayland.
Charles W. Freehan of Great Barrington.

Massachusetts Agricultural Experiment Station.

William P. Brooks, Ph.D.,	*Director.*
Joseph B. Lindsey, Ph.D.,	*Vice-Director.*
Frank A. Waugh, M.Sc.,	*Horticulturist.*
George E. Stone, Ph.D.,	*Botanist and Vegetable Pathologist.*
Henry T. Fernald, Ph.D.,	*Entomologist.*
James B. Paige, B.Sc., D.V.S.,	*Veterinarian.*
John E. Ostrander, A.M., C.E.,	*Meteorologist.*

AGRICULTURAL SOCIETIES INCORPORATED BY SPECIAL ACT OF THE LEGISLATURE, AND REPRESENTED ON THE BOARD OF AGRICULTURE.

NAME.	PRESIDENT.	SECRETARY.	TREASURER.
Amesbury and Salisbury,[1]	A. Willis Bartlett, Salisbury.	M. H. Sands, Amesbury.	Edwin W. Paige, Amesbury.
Barnstable County,	Thomas C. Thacher, Yarmouth.	Marcus N. Harris, Barnstable.	Henry C. Davis, Barnstable (P. O. Cummaquid).
Blackstone Valley,	W. A. L. Bazeley, Uxbridge.	M. R. Sharpe, Uxbridge.	C. A. Barton, Uxbridge.
Deerfield Valley,	Charles W. Trow, Buckland.	Francis W. Avery, Charlemont.	Charles T. Haskins, Charlemont.
Eastern Hampden,	Frank J. Hamilton, Palmer.	Fred E. Cady, Monson.	J. B. Dawson, Palmer.
Essex,	Charles H. Preston, Hathorne.	Walter H. Brown, Peabody.	W. S. Nichols, Salem.
Franklin County,	Frank Gerrett, Greenfield.	J. H. Murphy, Greenfield.	F. H. Snow, Greenfield.
Hampshire,	Francis E. Farrar, Amherst.	James W. T. Davis, Amherst.	James W. T. Davis, Amherst.
Hampshire, Franklin and Hampden,	Clarence E. Hodgkins, Northampton.	Charles A. Montgomery, Northampton.	A. J. Morse, Northampton.
Highland,	H. A. Ford, Windsor (P. O. Dalton).	John T. Bryan, Middlefield (P. O. Chester, R. F. D.).	W. A. Olds, Middlefield.
Hillside,	Charles A. Bisbee, Chesterfield.	Allen B. Doggett, Jr., Cummington.	Howard E. Drake, Cummington.
Hingham,[1]	Henry G. Jordan, Hingham.	William L. Howard, Hingham.	Harry F. Zahn, Hingham.
Hoosac Valley,	F. D. Stafford, North Adams.	George F. Miller, North Adams.	C. M. Ottman, North Adams.
Housatonic,	Fred M. Ford, Sheffield.	Joseph H. Maloney, Great Barrington.	George L. Taylor, Great Barrington.
Lenox Horticultural,	George A. Breed, Stockbridge.	John Carman,[2] Lenox.	A. J. Loveless, Lenox.
Marshfield,[1]	Thomas W. Lawson, Boston.	Israel H. Hatch, Marshfield (P. O. North Marshfield).	M. Herman Kent, Marshfield.
Martha's Vineyard,	Davis D. Look, West Tisbury (P. O. North Tisbury).	Leroy W. Luce, Chilmark.	George Hunt Luce, West Tisbury.
Massachusetts Horticultural,	J. K. M. L. Farquhar, Boston.	William P. Rich, 300 Massachusetts Ave., Boston.	Walter Hunnewell, 87 Milk St., Boston.
Massachusetts Society for Promoting Agriculture.	Charles Sprague Sargent, Brookline.	Francis Henry Appleton, Peabody, and 251 Marlboro St., Boston.	Richard M. Saltonstall, Newton.

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[1] And horticultural.

[2] Secretary *pro tem.*

AGRICULTURAL SOCIETIES, ETC. — *Concluded.*

NAME.	PRESIDENT.	SECRETARY.	TREASURER.
Middlesex North,	George W. Trull, Tewksbury (P. O. Lowell, R. F. D.).	George B. Coburn, Lowell.	John A. Weinbeck, Lowell.
Middlesex South,	John P. Bowditch, Framingham.	Peter N. Everett, Framingham.	George E. Fay, Framingham.
Nantucket,	John H. Bartlett, Nantucket.	Josiah F. Murphey, Nantucket.	Benjamin F. Worth, Nantucket.
Oxford,	Walter E. Schuster, Douglas.	James E. Darling, Oxford.	George E. Chaffee, Oxford.
Plymouth County,	Ernest Leach, Bridgewater.	Howard B. Wilbur, West Bridgewater and Barristers' Hall, Brockton.	Howard B. Wilbur, West Bridgewater and Barristers' Hall, Brockton.
Quannapowitt,	Henry A. Upton, North Reading.	E. Horace Perley, Wakefield.	Arthur W. Coolidge, Norwood.
Spencer Farmers' and Mechanics' Association,	Harry R. Prescott, Spencer.	George H. Ramer, Spencer.	George H. Ramer, Spencer.
Union,[1]	Joseph P. Haley, Blandford.	Enos W. Boise, Blandford.	George O. Millard, Blandford.
West Taunton,	Mason E. Marvel, Taunton.	Charles I. King, Taunton.	Whitman Chase, Taunton.
Weymouth (Agricultural and Industrial),	Ralph P. Burrell, Weymouth (P. O. South Weymouth).	Thomas V. Nash, Weymouth (P. O. South Weymouth).	D. Frank Daly, Weymouth (P. O. South Weymouth).
Worcester,	W. D. Ross, Worcester.	B. Durrell, Worcester.	L. F. Herrick, Worcester.
Worcester East,	Edward D. Emerson, Bolton.	D. W. O'Brien, Clinton.	John W. Forrester, Clinton.
Worcester North (Agricultural and Driving Association).	L. L. Richardson, Leominster.	E. E. Wilbar, Fitchburg.	R. H. Bingham, Fitchburg.
Worcester Northwest (Agricultural and Mechanical).	Clifford H. Smith, Athol.	Albert Ellsworth, Athol.	Clarence E. Deane, Athol.
Worcester South,	Herman T. Hyde, Southbridge.	George H. Clemence, Southbridge.	Ernest G. Barnes, Sturbridge.
Worcester County West,	William A. Gaston, Shawmut Bank Building, Boston and Barre.	D. H. Rice, Barre.	John S. Rice, Barre.

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[1] And horticultural.

Horticultural Societies.

NAME.	LOCATION.	PRESIDENT.	SECRETARY.
Hampden County,	Springfield,	J. Alden Davis, 36 Groveland St., Springfield.	Marshall Headle, 458 Dickinson St., Springfield.
Houghton,	Lynn,	David S. Day, 20 Webster St., Lynn.	Nettie L. Day, 20 Webster St., Lynn.
Medford,	Medford,	Mrs. Lester H. Williams, Bradlee Rd., Medford.	Mrs. Ruth W. Randall, 53 Forest St., Medford.
Melrose Horticultural and Improvement,	Melrose,	George D. Orton, 10 Ashland Pl., Melrose.	Mrs. Ralph O. Stantial, 55 Meridian St., Melrose.
New Bedford,	New Bedford,	David F. Roy, Marion.	Jeremiah M. Taber, 888 Rockdale Ave., New Bedford.
Worcester,	Worcester,	Edward W. Breed, 94 Prescott St., Clinton.	Leonard C. Midgley, Lyman St., Westborough.

Farmers' and Mechanics' Clubs and Associations.

Belchertown,	Belchertown,	Dwight F. Shumway, Belchertown.	R. E. Fairchild, Belchertown.
Bolton,[1]	Bolton,	Gilbert H. Wheeler, Bolton.	Harry W. Butts, Bolton.
Holden,	Holden,	Franklin C. Hubbard, Holden.	George M. Perry, Holden.
Needham,[1]	Needham,	G. Howard Frost, 200 Fuller St., West Newton.	Mrs. Alice M. Frost, 200 Fuller St., West Newton.
Pepperell,	Pepperell,	William E. Chapman, Pepperell.	Leroy A. Shattuck, Pepperell.
Shrewsbury,	Shrewsbury,	E. A. Bartlett, Shrewsbury.	Fred J. Stone, Shrewsbury.
Westminster,[1]	Westminster,	G. A. Sargent, Westminster.	E. C. Mansur, Westminster.

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[1] Association.

FARMERS' CLUBS.

NAME.	LOCATION.	PRESIDENT.	SECRETARY.
Boxborough,	Boxborough,	R. Y. Nelson, West Acton, R. F. D.	George W. Burroughs, West Acton.
Buckland,	Buckland,	F. L. Warfield, Buckland.	Mrs. J. W. Moulton, Buckland.
Concord,	Concord,	C. W. Prescott, Concord.	George M. Baker, Concord.
Easthampton,	Easthampton,	D. A. Forbes, West St., Easthampton.	R. H. Clapp, Clapp St., Easthampton.
East Charlemont,	East Charlemont,	William B. Avery, East Charlemont.	Horace Wells French, East Charlemont.
Easton,	Easton,	Wilmarth P. Howard, Purchase St., South Easton.	George Howard, Foundry St., South Easton.
Franklin,	Franklin,	Alden T. Mann, Franklin.	R. A. Messerli, Franklin.
Halifax,	Halifax,	James T. Thomas, Halifax.	Mrs. Carrie A. Hayward, Halifax.
Medway,	Medway,	Charles A. Wilson, Medway.	Linton G. Sevrens, West Medway.
New Braintree,	New Braintree,	Edwin L. Havens, New Braintree.	Walter L. McClanathan, Barre Plains.
Oakham,	Oakham,	Jesse Allen, Oakham.	Mrs. Caroline D. Fairbanks, Oakham.
South Bristol,	New Bedford,	Elmer M. Poole, North Dartmouth.	Allen Russell, Acushnet.
Tatnuck,	Worcester,	Charles T. Foster, Hadwen Rd., Worcester.	H. Ward Moore, 28 Amherst St., Worcester.
Upton,	Upton,	Benj. C. Wood, Upton.	Edward B. Newton, Upton.
West Brookfield,	West Brookfield,	William E. Patrick, Warren.	Sumner H. Reed, Brookfield.

POULTRY ASSOCIATIONS.

NAME.	LOCATION.	PRESIDENT.	SECRETARY.
Abington Poultry Association,	Abington,	Charles E. Allen, 122 Walnut St., Abington.	Edward C. Cushing, 81 Lake St., Abington.
Amherst Poultry Association,	Amherst,	George H. Cadwell, Amherst.	William H. Abbott, Amherst.
Attleboro Poultry Association,	Attleboro,	W. H. Saart, Attleboro.	John H. Hickey, 227 Pleasant St., Attleboro.
Boston Poultry Association,	Boston,	John Lowell, Chestnut Hill.	W. B. Atherton, 36 Bromfield St., Boston.
Dalton Poultry, Pigeon and Pet Stock Association.	Dalton,	George C. Maynard, Dalton.	Leroy P. Adams, Dalton.

Eastern Massachusetts Poultry and Pigeon Association.	Everett,	Chas. E. Pepper, 91 Central St., Everett.	Henry C. Green, 100 Vernal St., Everett.
Essex County Poultry Association,	Essex County,	J. D. Barnes, Wenham.	Arthur Elliot, Peabody.
Holyoke Poultry and Pet Stock Association, Inc.,	Holyoke,	George H. Cadwell, Amherst.	George Barnett, Jr., 534 South St., Holyoke.
Lawrence Poultry, Pigeon and Pet Stock Association.	Lawrence,	Joseph Adams, 64 Woodland St., Lawrence.	F. J. Borneman, 10 Moran Ct., Lawrence.
Lenox Poultry Association, Inc.,	Lenox,	William J. Welsh, Lenox.	Geo. A. Mole, Lenox.
Mansfield Poultry, Pigeon and Pet Stock Association, Inc.	Mansfield,	C. H. Budlong, Park St., Mansfield.	L. Faye Howe, 56 Draper Ave., Mansfield.
Massachusetts Poultry Association, Inc.,	The State,	Charles L. Wilder, Lancaster.	Charles E. Allen, 111 Devonshire St., Boston.
Milford Poultry Association,	Milford,	James Nolan, Milford.	W. H. Pyne, Milford.
New England Poultry Association,	Greenfield,	S. H. Stone, 12 Walnut St., Greenfield.	Harvey Morse, Oak St., Greenfield.
Northern Berkshire Poultry Association, Inc.,	North Adams,	H. F. Dodge, Pittsfield.	Albert Whitney, North Adams.
Northampton Poultry Association,	Northampton,	Will N. Doane, Northampton.	J. Hugh Pierce, Northampton.
Quannapowitt Poultry Association,	Wakefield,	W. W. Greenough, Wakefield.	R. C. Atkinson, Wakefield.
Southern Massachusetts Poultry and Pet Stock Association.	New Bedford,	Bancroft Winsor, Acushnet.	Dr. S. D. Perry, 736 Pleasant St., New Bedford.
Springfield Poultry Club, Inc.,	Springfield,	W. E. Blodgett, Springfield, Box 1226.	W. C. Roraback, Springfield, Box 1226.
Worcester North Poultry Association,	Worcester,	C. L. Wilder, Lancaster.	H. E. Spaulding, 16 Thomas St., Fitchburg.
Worcester Poultry Association, Inc.,	Worcester,	William H. Fitton, 42 Richmond Ave., Worcester.	Charles H. Wood, 340 Main St., Room 715, Worcester.

BEEKEEPERS' SOCIETIES AND ASSOCIATIONS.

Berkshire County Beekeepers' Association,	Berkshire County,	C. M. Musgrove, Pittsfield.	John Buckler, Pittsfield.
Eastern Massachusetts Society of Beekeepers,	Boston,	Thomas J. Hawkins, 4 Emery St., Everett.	Benjamin P. Sands, 1051 Old South Building, Boston.
German Bee Society,	Lawrence and Methuen,	John Uller, 100 Midland St., Lawrence.	Paul Loeffler, 59 Baremeadow St., Methuen.
Hampshire, Hampden and Franklin Beekeepers' Association.	Hampshire, Hampden and Franklin Counties.	O. M. Smith, Florence.	Burton N. Gates, Amherst.
Massachusetts Society of Beekeepers,	The State,	Frank W. Frisbee, North Andover.	Lyman E. Ware, Norfolk.
State Beekeepers' Association of Massachusetts,	The State,	John L. Byard, Amherst.	Burton N. Gates, Amherst.
Worcester County Beekeepers' Association,	Worcester,	O. F. Fuller, Blackstone.	J. Sidney Whittemore, Leicester.

Farm Bureaus and County Improvement Leagues.

NAME.	LOCATION.	PRESIDENT.	SECRETARY.
Franklin County Farm Bureau, Inc.,	Greenfield,	Joseph W. Stevens, First National Bank, Greenfield.	John D. Willard, 12 Sheldon Block, Greenfield.
Hampden County Improvement League,	Springfield,	Horace A. Moses, Mittineague.	John A. Scheuerle, 244 Main St., Springfield.
Hampshire County Farm Bureau,	Northampton,	Charles R. Damon, Williamsburg.	John J. Kennedy, Northampton.
Norfolk County Farm Bureau,	Dedham,	Evan F. Richardson, Millis.	Ernest H. Gilbert, North Easton, R. F. D. 1.
Plymouth County Farm Bureau,	Brockton,	Lyman P. Thomas, Middleborough.	William Littler, Chamber of Commerce, Brockton.
Worcester County Farm Bureau,	Worcester,	Hon. J. Lewis Ellsworth, 11 Foster St., Worcester.	Charles H. White, 11 Foster St., Worcester.

Miscellaneous.

NAME.	LOCATION.	PRESIDENT.	SECRETARY.
Boston Market Gardeners' Association,	Boston,	H. F. Arnold, Braintree.	James P. Esty, Newton Centre.
Brockton Agricultural Society,	Brockton,	Charles Howard, Brockton.	Perley G. Flint, Brockton.
Cape Cod Cranberry Growers' Association,	Wareham,	John C. Makepeace, Wareham.	L. C. Hall, Wareham.
Connecticut Valley Breeders' Association,	Amherst,	J. G. Cook, Hadley.	G. F. Story, Amherst.
Franklin Harvest Club,	Franklin and Hampshire Counties.	Josiah W. Parsons, Northampton.	W. M. Purrington, Williamsburg (P. O. Haydenville).
Gardeners' and Florists' Club of Boston,	Boston,	Herman H. Bartoch, Belmont (P. O. Waverley).	William N. Craig, Brookline.
Hampden County Fair, Inc.,	Holyoke,	Dr. Thomas J. Shinkwin, Holyoke.	David H. Young, Holyoke.
Hampden Harvest Club,	Connecticut Valley,	No regular president.	John A. Scheuerle, 244 Main St., Springfield.
Massachusetts Agricultural Club,	Boston,	James Murray Kay, 4 Park St., Boston.	Henry G. Pickering, 10 Tremont St., Boston.
Massachusetts Cattle Owners' Association,	State,	Frederick A. Russell, Methuen.	James L. Harrington, Lunenburg.
Massachusetts Creamerymen's Association,	The State,	W. A. Harlow, Cummington.	W. P. B. Lockwood, Amherst.
Massachusetts Dairymen's Association,	The State,	H. S. Cheney, Southbridge.	W. P. B. Lockwood, Amherst.
Massachusetts Federation for Rural Progress,	The State,	Kenyon L. Butterfield, Amherst.	E. L. Morgan, Amherst.

Massachusetts Forestry Association,	Boston,	Nathaniel T. Kidder, 69 Ames Building, Boston.	Harris A. Reynolds, 4 Joy St., Boston.
Massachusetts Fruit Growers' Association,	The State,	Fred C. Sears, Amherst.	F. Howard Brown, Marlborough.
Massachusetts Nurserymen's Association,	The State,	Charles Adams, Springfield.	Winthrop H. Thurlow, West Newbury.
New England Corn Exposition, Inc.,	New England,	W. D. Ross, Worcester.	F. L. Weare, Seabrook, New Hampshire.
New England Federation for Rural Progress,	New England,	Leon S. Merrill, Orono, Maine.	Jas. A. McKibben, Chamber of Commerce Building, Boston.
New England Federation of Agricultural Students.	New England,	W. C. Kennedy, Amherst.	Merle R. Young, Storrs, Connecticut.
New England Fruit Show,	New England,	J. Lewis Ellsworth, Worcester.	F. Howard Brown, Ferncroft Rd., Marlborough.
New England Nurserymen's Association,	New England,	G. H. Greaton, Providence, Rhode Island.	Daniel Clark, Fiskeville, Rhode Island.
Southern New England County Fair,	Dartmouth,	Elton S. Wilde, New Bedford.	Charles T. Battey, New Bedford.
Stockbridge Club,	Amherst,	Ralph F. Taber, Amherst.	Donald H. Caude, Amherst.
Worcester County Harvest Club,	Worcester,	Hermon T. Hyde, Southbridge.	Mrs. D. A. Howe, 8 Burncoat St., Worcester.
Ware Agricultural and Driving Association,	Ware,	T. P. Strong, 108 Church St., Ware.	James E. Kennedy, 84 Water St., Ware.

MASSACHUSETTS PATRONS OF HUSBANDRY.

OFFICERS OF THE STATE GRANGE, 1915.

Master,	Edward E. Chapman of Ludlow.
Overseer,	Leslie R. Smith of Hadley.
Lecturer,	Mrs. George S. Ladd of Sturbridge.
Steward,	E. H. Gilbert of Stoughton (P. O. address, North Easton).
Assistant Steward,	Henry N. Jenks of Cheshire (P. O. address, Adams, R. F. D.).
Chaplain,	Rev. A. H. Wheelock of Marlborough.
Treasurer,	Hon. F. A. Harrington of Worcester.
Secretary,	William N. Howard of Easton (P. O. address, North Easton).
Gate Keeper,	Samuel T. Brightman of Westport (P. O. address, Central Village).
Ceres,	Mrs. Sarah H. Holland of Millis.
Pomona,	Mrs. Evelyn M. Adams of West Tisbury.
Flora,	Mrs. Laura M. Sargent of Amesbury.
Lady Assistant Steward,	Mrs. Margaret A. Sarre, 537 Merrimack St., Lowell.

EXECUTIVE COMMITTEE.

Carlton D. Richardson,	West Brookfield.
Warren C. Jewett,	Worcester.
George S. Ladd,	Sturbridge.

GENERAL DEPUTIES.

N. B. Douglas,	Sherborn.
E. D. Howe,	Marlborough.
W. C. Jewett,	Worcester.
G. S. Ladd,	Sturbridge.
C. D. Richardson,	West Brookfield.
C. M. Gardner,	Westfield.

ORGANIZING DEPUTY.

William T. Herrick,	Westborough.

POMONA DEPUTIES.

Joseph W. Baldwin,	North Easton.
Walter H. Sawyer,	Winchendon.
Hermon W. King,	East Longmeadow.
Elbridge Noyes,	Newbury.

SUBORDINATE DEPUTIES.

George W. Sherman,	Brimfield.
Charles R. Damon,	Williamsburg.
Ward A. Harlow,	Cummington.
Edwin B. Hale,	Bernardston.
John Bursley,	Barnstable (P. O. address, West Barnstable).
Moses U. Gaskill,	Mendon.
Horace E. Wallis,	Waltham.
Charles H. Preston,	Danvers (P. O. address, Hathorne).
Dr. M. H. Williams,	Sunderland.
Fred E. Alden,	Easton (P. O. address, South Easton, R. F. D.).

SUBORDINATE DEPUTIES — *Con.*

Norman L. Peavey,	Lowell, R. F. D. 3.
Dr. A. W. Gorham,	North Hanson.
Peter I. Adams,	Stockbridge (P. O. Housatonic).
George A. Witherell,	Orange.
Harry D. Towne,	Millers Falls.
George L. Averill,	Andover.
Everett W. Stone,	Auburn.
Harold J. Greenwood,	193 May St., Worcester.
George C. Donaldson,	Hamilton (P. O. address, South Hamilton).
Frank T. Marston,	Melrose.
Raymond J. Gregory,	Princeton.
John J. Glynn,	Dalton.
Walter H. Brown,	Peabody (P. O. address, West Peabody).
Harold A. Goff,	Rehoboth (P. O. address, Attleboro, R. F. D.).
John R. Comeley,	Bedford.
Clifford R. Ripley,	Blandford.
Lester H. Hayward,	North Reading.
Henry W. Holman,	Fitchburg.

JUVENILE GRANGE DEPUTY.

Mrs. S. Ella Stevens,	Athol.

SPECIAL DEPUTIES.

William N. Howard,	North Easton.
John P. Ranger,	North Brookfield.
Charles A. Wright,	Billerica.
Charles H. Shaylor,	Lee.

COMMITTEE ON BIRDS.

Raymond J. Gregory, *Chairman*,	Princeton.
Mrs. E. O. Marshall, *Secretary*,	New Salem.
George C. Donaldson,	South Hamilton.
Clayton E. Stone,	Lunenburg.
Mrs. Ida Farr Miller,	Wakefield.
Mrs. George H. Mellen,	Newton Highlands.
Rev. Sylvester P. Robertson,	Plainfield.

TRUSTEES OF EDUCATIONAL FUND.

Evan S. Richardson, *Chairman*,	Millis.
Mrs. George S. Ladd, *Secretary*,	Sturbridge.
James C. Poor, *Treasurer*,	North Andover.
Edward E. Chapman,	Ludlow.

COMMITTEE ON DEGREE STAFFS.

Mrs. Sarah H. Holland,	Millis.
Mrs. Fred J. Reed,	Shrewsbury.

COMMITTEE ON PATRIOTIC WORK.

E. H. Dunbar, *Chairman*,	Dedham.
G. B. Germain, *Secretary*,	Middleborough (P. O. address, Rock).
N. B. Douglas, *Treasurer*,	Sherborn.
Mrs. Grace Brock,	Leominster.
Mrs. Anna K. Day,	Bradford.

MASSACHUSETTS PATRONS OF HUSBANDRY — *Continued.*

NAME.	MASTER.	LECTURER.	SECRETARY.
Pomona Granges.			
Middlesex and Norfolk, No. 1,	Lewis B. Paine, Dover.	Abel F. Stevens, Wellesley.	Mrs. Emma C. Luce, Framingham Centre.
Essex County, No. 2,	Ralph A. Bailey, Andover.	Albert P. Wadleigh, Merrimac.	Miss Matilda B. Lund, Ward Hill, R. F. D.
Middlesex-Worcester, No. 3,	Richard T. Barrows, Concord Junction, R. F. D.	Mrs. Alice E. Cummings, Shirley.	Mrs. Minnie L. F. Knight, Townsend Harbor.
Franklin and Worcester, No. 4,	E. S. Putnam, Wendell Depot.	Mrs. Anna L. Bacon, Athol.	Mrs. Minnie W. Spaulding, Athol.
Worcester West, No. 5,	John Putnam, Baldwinville.	S. Alice Hillman, Hardwick.	Mrs. Rachel S. Titterton, Palmer.
Berkshire North, No. 6,	John J. Glynn, Dalton.	Mrs. A. N. Hillier, Pittsfield.	Mrs. Bessie S. Wellington, Pittsfield.
Worcester Central, No. 7,	H. Ward Moore, 27 Amherst St., Worcester.	Mrs. Howard G. Ramsey, Uxbridge.	Mrs. A. E. Grout, Millbury.
Hampshire County, No. 8,	F. O. Williams, Sunderland.	Mrs. R. A. Warner, Williamsburg.	Mrs. Chas. R. Damon, Williamsburg.
Worcester Southwest, No. 9,	William Casey, Charlton Depot.	Mrs. Nettie M. Webster, Sturbridge.	Mrs. Mabel A. Nichols, East Brookfield, R. F. D.
Worcester and Norfolk, No. 10,	Wesley E. Howes, Medway, R. F. D.	Lyman Cook, South Milford.	Miss Olive May Clark, Bellingham.
Borough, No. 11,	Willis E. Wheeler, Northborough.	Miss Clare Mackay, Stow.	Mrs. M. A. Gilmore, Westborough, R. F. D.
The Springfield, No. 12,	Francis L. Jones, Palmer.	Miss I. Chapman, Ludlow.	Mrs. C. L. Hayward, Agawam.
Old Colony North, No. 13,	Joseph W. Baldwin, North Easton.	Miss Isabel C. McIntyre, Mattapan.	Mrs. Alida N. Stevens, 75 Tremont St., South Braintree.
Worcester East, No. 14,	Henry A. Knight, Harvard.	Mrs. Amos Wheeler, Bolton.	Mrs. Ida A. Cunningham, Lancaster.
Quaboag, No. 15,	Fred N. Lawrence, Brimfield.	Mrs. Ida L. Warren, Leicester.	Mrs. Amelia K. Faxon, Spencer.
Middlesex North, No. 16,	Charles A. Wright, Billerica.	Mrs. Nettie O. Wilson, Carlisle.	Mrs. Lulu M. Hutchins, Billerica.
Deerfield Valley, No. 17,	George E. Clark, Lyonsville.	Mrs. F. L. Warfield, Buckland.	Clinton H. Hawks, Charlemont.
Western Hampden, No. 18,	Clifford R. Ripley, Blandford.	W. A. Munson, Huntington.	Miss Annette Sackett, Westfield.
Connecticut Valley, No. 19,	Ernest C. Atherton, Turner's Falls.	Mrs. Alice M. Jones, Turner's Falls.	Mrs. Emma L. Barton, Turner's Falls.
Hillside, No. 20,	Edwin Gloyd, Plainfield.	Mrs. S. P. Robertson, Plainfield.	Mrs. G. L. Miner, Dalton.
Swift River Valley, No. 21,	Edgar D. Winslow, Ware.	Mrs. Ella M. Winslow, Ware.	Miss Jennie P. Dodge, Enfield.
Mayflower, No. 22,	W. H. Spear, South Weymouth.	Mrs. Emily Baker, South Hanson.	Winthrop Fillebrown, Bryantville, R. F. D.
Middlesex Central, No. 23,	John R. Comely, Bedford.	Mrs. Maud Moore Clark, South Sudbury.	Frederick W. Taylor, Concord Junction.

Cape Cod, No. 24,	Frank E. Howes, Dennis.	John F. Carleton, East Sandwich.	Henry C. Davis, Cummaquid.
Berkshire South, No. 25,	L. R. Miller, Great Barrington.	Mrs. E. R. Baldwin, Great Barrington, R. F. D. 3.	Albert Chapin, Sheffield.
Chebacco, No. 26,	Walter H. Brown, West Peabody.	Mrs. Allen I. Fogg, Topsfield.	Miss Isabelle Dodge, 200 Dodge St., Beverly.
Norfolk, No. 27,	Woodsworth J. Rice, Millis.	Irad H. Bigelow, Norwood.	Mrs. Carrie C. Snyder, Walpole.
Middlesex-Essex, No. 28,	Charles B. Osbon, Wilmington.	Angier L. Goodwin, Melrose.	Miss Mary C. Breslin, Woburn.
Old Colony South, No. 29,	Henry L. Denham, Mattapoisett.	Mrs. Luella A. Green, Taunton, R. F. D.	Mrs. Hannah Briggs, Dartmouth.
Subordinate Granges.			
"Guiding Star" of Greenfield, No. 1,	Hosea B. Mowry, Leyden Rd., Greenfield.	Mrs. Mabel R. Holden, 22 Hayward St., Greenfield.	Mrs. Agnes M. Handforth, 27 Norwood St., Greenfield.
Northfield, No. 3,	L. R. Alexander, Northfield.	Mrs. L. O. Clapp, Northfield.	Mrs. T. R. Callender, Northfield.
Groton, No. 7,	Elmer Sawyer, Groton.	Mrs. Virginia H. Tyrell, Groton.	Miss Lois M. Wright, Groton.
Barre, No. 9,	Henry A. Moore, Barre.	Mrs. Henry B. Read, Barre.	Miss Eva Williams, Barre.
Pittsfield, No. 14,	John Buckler, Blythewood Farms, Pittsfield.	Mrs. Emilie D. Clark, 10 Myrtle St., Pittsfield.	Ralph H. Elmer, Box 1265, Pittsfield.
"Hope" of Hadley, No. 15,	Harold D. Barstow, South Hadley, R. F. D.	James Reed, Hadley.	Mrs. Harold West, Hadley.
Amherst, No. 16,	F. P. Scott, North Hadley.	Mrs. C. O. Goodale, Amherst.	Mrs. C. M. Hibbard, Amherst.
Cheshire, No. 17,	Alden Ingalls, Berkshire.	Miss Grace Phelps, Adams.	Mrs. F. W. Cox, Cheshire.
Hinsdale, No. 19,	Harry E. Gardner, Hinsdale.	Mrs. F. M. Griffen, Hinsdale.	Mrs. H. E. Gardner, Hinsdale.
Westfield, No. 20,	Wayne D. Wood, Westfield.	Miss Eva F. Dorman, Westfield.	Miss Annette Sackett, Westfield.
Lanesborough, No. 21,	W. A. Akeroyd, Lanesborough.	Mrs. Harriet B. Rice, Lanesborough.	Miss Ethel R. Wood, Lanesborough.
Worcester, No. 22,	Frederick Midgley, 357 Massasoit Rd., Worcester.	Mrs. John A. Dean, 7 Vincent Ave., Worcester.	Mrs. Minnie Perrin, 45 Howland Terrace, Worcester.
Dalton, No. 23,	Wesley B. Barton, Dalton.	Mrs. Jeannette Glynn, Dalton.	Mrs. Lephia O. Warren, Dalton.
Blandford, No. 24,	F. C. Knittel, Blandford.	Rev. M. D. Merchant, Blandford.	Miss N. R. Ripley, Chester, R. F. D.
Easthampton, No. 27,	W. B. Drury, 167 Union St., Easthampton.	Mrs. M. L. Hughes, Easthampton, R. F. D.	Miss Lillian Bristow, 15 Fairfield Ave., Easthampton.
Richmond, No. 32,	John North, Richmond.	Arthur L. Reynolds, Richmond.	Miss Ida H. Barnes, Richmond.
Adams, No. 34,	Dormant.	– –	– –
Lenox, No. 35,	Frank A. Dunbar, West Stockbridge, R. F. D.	Gladys I. Terrill, Lenox.	Horatio H. Sears, New Lenox.
Russell, No. 36,	Harry C. Dewey, Russell.	Miss Minnie Boyden, Russell.	Mrs. Gertrude Rogers, Russell.

MASSACHUSETTS PATRONS OF HUSBANDRY — *Continued.*

NAME.	MASTER.	LECTURER.	SECRETARY.
"Thrifty" of Leverett, No. 37,	Chas. L. Putney, Hillsborough.	Miss Ethel H. Beaman, Leverett.	Mrs. Geo. W. Morrison, Leverett.
Granville, No. 40,	Mrs. Harry S. Hartley, Granville.	Mrs. Lucy M. Dickinson, Granville.	Mrs. Lena P. Church, Granville.
Montgomery, No. 45,	Myron E. Kelso, Montgomery.	Mrs. D. H. Hall, Montgomery.	Miss A. Williams, Montgomery.
Southwick, No. 46,	B. M. Hastings, Southwick.	Mrs. F. D. Lamson, Southwick.	C. A. Griffin, Southwick.
Becket, No. 47,	Arthur L. Hays, Becket.	Merton E. Johnson, Becket.	Mrs. Mattie Irrgang, Becket.
"Highland" of Huntington, No. 48,	Rev. H. A. M. Briggs, Huntington.	Mrs. R. A. Jenkins, Huntington.	Miss Orlena Cadwell, Huntington.
"Granite" of South Worthington, No. 49.	R. H. Adams, Ringville.	Mrs. R. H. Bradley, South Worthington.	Mrs. Lora P. Adams, Ringville.
"Golden Rule" of Prescott, No. 52,	Howard I. Shaw, Greenwich Village.	Mrs. A. E. Laplante, Greenwich Village.	Miss Helen Reed, Prescott.
Sterling, No. 53,	G. A. White, Sterling.	Mrs. W. A. Dingley, Pratt's Junction.	Frank P. Elliott, Sterling.
Springfield, No. 54,	Henry A. Booth, 310 Main St., Springfield.	Albert R. Jenks, 82 Hall St., Springfield.	Mrs. Nellie M. Mason, 37 Silver St., Springfield.
Cummington, No. 56,	C. Ashley Stevens, Cummington.	Mrs. Arthur Giles, Cummington.	Herbert G. Streeter, Cummington.
Auburn, No. 60,	Fred M. Jewell, 33 Caro St., Worcester.	Linnie E. Keep, Auburn.	Mrs. G. P. Whittemore, Auburn.
Egremont, No. 63,	A. A. Dunlop, Great Barrington, R. F. D. 3.	Mrs. E. R. Baldwin, Great Barrington, R. F. D. 3.	Mrs. A. Dunlop, Great Barrington, R. F. D. 3.
"Union" of Belchertown, No. 61,	Myron G. Ward, Belchertown.	Mrs. Della Squires, Belchertown.	Mrs. Lillian Kelley, Belchertown.
Brimfield, No. 65,	Robert C. Sherman, Brimfield, R. F. D. 1.	Edward S. Wells, Palmer, R. F. D.	Mrs. Mary K. Hitchcock, Brimfield.
Charlemont, No. 66,	Horace Warfield, Charlemont.	Herbert T. Walker, Charlemont.	D. J. Davenport, Charlemont, R. F. D. 2.
Hardwick, No. 67,	John S. Clark, Hardwick.	Miss A. M. Hillman, Hardwick.	Mrs. Howard E. Noble, Hardwick.
Shelburne, No. 68,	D. T. Barnard, Shelburne.	Mrs. George E. McClellan, Shelburne.	Cyrus S. Bardwell, Shelburne.
Ashfield, No. 69,	Clinton Wing, Ashfield.	Mrs. C. A. Smith, Ashfield.	Mrs. Wm. H. Howes, Ashfield.
Phillipston, No. 70,	A. D. Clifford, Athol, R. F. D. 3.	D. W. Baker, Athol, R. F. D. 3.	Mrs. Cora A. Dunton, Phillipston.
Leyden, No. 71,	Herman W. Severance, Bernardston, R. F. D. 2.	Mrs. Gratia E. Campbell, Greenfield, care of Leyden Stage.	Mrs. Lucy M. Howes, Leyden.
"Prescott" of Pepperell, No. 73,	Walter L. Shattuck, East Pepperell.	Amy L. Shattuck, East Pepperell.	Ellen Miller, Pepperell.
Princeton, No. 74,	Edward W. Brunsen, Princeton.	Miss Ethel R. Mirick, Princeton.	Miss Florence E. Bryant, Brooks Station.
Colrain, No. 76,	I. G. Call, Shattuckville.	Nita Hathaway, Lyonsville.	Alice Bardwell, Shattuckville.
Windsor, No. 77,	Harry L. Taylor, East Windsor.	Mrs. Mary E. Taylor, East Windsor.	Mrs. S. Ethel Ball, East Windsor.
Holden, No. 78,	Reuben H. Moore, Holden, R. F. D.	Loring W. Hubbard, Holden.	Miss Marguerite Drawbridge, Holden.

Spencer, No. 79,	Brittan Jackson, Spencer.	Mrs. Edward E. Warren, Leicester.	Miss Bertha M. Smith, Spencer.
Bernardston, No. 81,	Clarence S. Hale, Bernardston.	Dr. Edward B. Hodskins, Bernardston.	Hugh E. Adams, Bernardston.
"Manhan" of Southampton, No. 82,	C. S. Hooker, Southampton.	Mrs. Edwin Phelps, Southampton.	Miss Julia E. Norris, Southampton.
Chesterfield, No. 83,	Frank P. Baker, Bisbees.	Mrs. Frank Baker, Bisbees.	M. T. Anderson, Chesterfield.
Warwick, No. 85,	Sidney J. White, Warwick.	Mrs. Lilla M. Prouty, Warwick.	George A. Witherell, Orange.
North Orange, No. 86,	H. Floyd French, North Orange.	Mrs. P. Weller, North Orange.	G. A. Miller, North Orange.
Buckland, No. 87,	Fred L. Warfield, Buckland.	Mrs. Fleta Griswold, Buckland.	Miss Alice L. Maynard, Buckland.
Lee, No. 88,	Duane S. Slater, Tyringham.	Mrs. Charles Markham, Lee.	Hugh Johnston, Lee, Box 69.
Worthington, No. 90,	Frank R. Scott, Worthington.	Mrs. Fred H. Fairman, Cummington, R. F. D.	Arthur G. Capen, Worthington.
Charlton, No. 92,	John G. Hammond, Dodge, R. F. D.	William Casey, Charlton Depot.	Mrs. Rosa E. Bowers, Charlton Depot.
Grafton, No. 93,	Raymond F. Johnson, North Grafton.	Mrs. Barbara E. Goff, Grafton.	Albert R. Jones, North Grafton.
Petersham, No. 95,	Benj. W. Towne, Petersham.	Mrs. Alice S. Phillips, Petersham.	Mrs. Ruby J. Stone, Petersham.
Savoy, No. 99,	Dormant.	– –	– –
Shrewsbury, No. 101,	Charles M. Field, Shrewsbury.	Edward A. Logan, Shrewsbury.	Mrs. M. E. Chamberlin, Shrewsbury.
Stow, No. 103,	Phillip N. Glazier, Maynard.	Mrs. Mary Hendy, Maynard.	Miss Elmer B. Conant, Maynard.
"Garfield" of North Dana, No. 104,	Celia Whitaker, North Dana.	Mrs. E. C. Mathews, North Dana.	Mrs. Effie L. Thayer, North Dana.
Marlborough, No. 105,	R. Harvy Taylor, 14 Pleasant Ct., Marlborough.	Ernest P. Carr, 97 Newton St., Marlborough.	Mrs. L. M. Howe, Fair View Farm, Marlborough.
West Boylston, No. 106,	Everett G. Record, West Boylston.	Mrs. Clara Rice, West Boylston.	Mrs. Mary E. Phelps, West Boylston.
Millbury, No. 107,	Lloyd A. Glover, West Millbury.	Miss Ruth Carter, Millbury.	Miss Carolyn Brunninghaus, Millbury.
Hudson, No. 108,	Alfred F. Ordway, Hudson.	Willis Muzzy, Hudson.	Mrs. Mary E. Lawrence, 55 Lincoln St., Hudson.
Sutton, No. 109,	F. W. Rosebrooks, Sutton, R. F. D.	Walter J. King, Sutton, R. F. D.	Mrs. R. Richardson, Sutton, R. F. D.
Sherborn, No. 110,	Arthur R. Wright, Sherborn.	Aaron C. Dowse, Sherborn.	Miss Julia N. Daniels, Sherborn.
Boylston, No. 111,	F. C. Hall, Boylston, R. F. D.	Mrs. Mary E. Stark, Boylston.	Mrs. L. Longley, Boylston.
"East Medway" of Millis, No. 112,	Edw. G. W. Stafford, Millis.	Woodworth J. Rice, Millis.	Edw. E. Adams, Millis.
Framingham, No. 113,	Frank E. Tatreau, R. F. D. 2, Framingham.	Mrs. Carry M. Emery, Framingham.	George E. Fay, 35 Winter St., Framingham.
Medfield, No. 114,	W. E. Morris, Medfield.	Mrs. Clara A. Clark, Medfield.	Mrs. E. C. Stone, Medfield.
Holliston, No. 115,	Henry E. Whipple, Holliston.	Mrs. Lottie M. Champney, Holliston.	Mrs. N. V. Pope, Holliston.
Westborough, No. 116,	Fred C. Wetherhead, Westborough.	Mrs. Edna Bullen, Westborough.	Mrs. Julia H. Rogers, Westborough.
Dover, No. 117,	Charles S. Bean, Charles River.	Mrs. Inez M. Packard, Needham, R. F. D.	Miss Amy Gallagher, Dover.
Southborough, No. 118,	Walter B. Brewer, Framingham, R. F. D.	Wm. H. Onthank, Southborough, R. F. D.	Mrs. Fred Wells, Fayville.
Northborough, No. 119,	Arthur A. Phelps, Northborough.	Mrs. Fannie B. Hildreth, Northborough.	Miss Ethel M. Davis, Northborough.

MASSACHUSETTS PATRONS OF HUSBANDRY — *Continued.*

NAME.	MASTER.	LECTURER.	SECRETARY.
Lancaster, No. 120,	Horace E. Johnson, Lancaster.	Mrs. Ida Stedman, Clinton.	J. Fred Brown, South Lancaster.
Sudbury, No. 121,	Rev. George H. Clark, South Sudbury, R. F. D.	Miss Winifred C. Baker, South Sudbury.	Mrs. Ida J. Rice, Maynard, R. F. D.
Templeton, No. 122,	Charles L. Rich, Templeton.	Mrs. Isabella Bunnheimer, Templeton.	Harold Aikeu, Templeton.
Oxford, No. 123,	E. Burton Appleby, Oxford.	Miss Florence P. Turner, Oxford.	Miss Gladys C. White, Oxford.
Ashland, No. 124,	Hiram A. Hotchkiss, Ashland.	Mrs. Ellen G. Stone, Ashland.	Mrs. Eliza D. Burr, Ashland, Box 21.
Upton, No. 125,	Miss Myrtice S. King, Upton.	Miss Minna J. Sanborn, Upton.	Mrs. L. Jennie Chapman, West Upton.
Hubbardston, No. 126,	John Cunningham, Hubbardston.	Mrs. Gertrude S. Rollins, Hubbardston.	Miss Grace R. Prentiss, Hubbardston.
Amesbury, No. 127,	Charles G. Copeland, General Delivery, Amesbury.	Miss Carrie M. Allen, 17 Greenwood St., Amesbury.	Miss A. L. Bartlett, Salisbury, R. F. D. 1.
North Andover, No. 128,	Wilbur J. Hunt, North Andover.	Miss Jessie Barker, North Andover.	Walter H. Hayes, North Andover.
Lincoln, No. 129,	Harold S. Cousins, South Lincoln.	Miss Priscilla C. Ames, Lincoln.	Francis B. Sargent, Concord, R. F. D.
Gardner, No. 130,	Charles J. Crabtree, Whitney St., Gardner.	Mrs. Ida T. Marshall, Rich St., Gardner.	Mrs. Mabel C. Bolster, 66 Glenwood St., Gardner.
Boxborough, No. 131,	Charles H. Richardson, West Acton, R. F. D.	Mrs. M. Burroughs, West Acton.	Mrs. Ada B. Durkee, West Acton, R. F. D. 1.
North Brookfield, No. 132,	Leon A. Doane, North Brookfield.	Mrs. Lila Lidstone, North Brookfield.	Mrs. Lizzie A. Clapp, North Brookfield.
Berlin, No. 134,	Lemuel D. Carter, West Berlin.	Mrs. F. H. Turnbull, Berlin.	Mrs. Bertha M. Cole, Berlin.
Norfolk, No. 135,	Frank Ordway, Norfolk.	Mrs. Hattie B. Day, Norfolk.	Mrs. Edna Hubbard, Norfolk.
Ipswich, No. 136,	Albert Elwell, Ipswich.	Fred D. Harris, Washington St., Ipswich.	Mrs. Mildred C. Murdock, Upland Farm, Ipswich.
East Blackstone, No. 137,	Philip E. Thomas, Woonsocket, R. I.	Edward M. Hammann, Blackstone, R. F. D.	Miss Lora A. Estes, Blackstone, R. F. D.
Northampton, No. 138,	Albert Dyer, Northampton.	Mrs. Annie Davies, Northampton.	Mrs. Bessie Gloyd, Northampton.
East Sandwich, No. 139,	Allen H. Jones, South Sandwich.	A. W. Higgins, Sandwich.	Mrs. Dorothy N. Holway, East Sandwich.
West Boxford, No. 140,	Harry L. Cole, Georgetown, R. F. D. 2.	Mrs. Hattie F. Chadwick, West Boxford.	Miss Matilda B. Lund, Ward Hill, R. F. D. 1.
Montague, No. 141,	Ernest C. Robinson, Montague.	Mrs. L. C. Newton, Montague, R. F. D.	Mrs. Kate A. Hayden, Montague.
Bolton, No. 142,	Francis G. Mentzer, Bolton.	Mrs. George L. Taylor, Bolton.	E. E. Hurlbut, Bolton.

Mendon, No. 143,	Freeman C. Lowell, Mendon.	Mrs. J. Grace Lowell, Mendon.	Mrs. L. W. Holbrook, Mendon.
Franklin, No. 144,	George A. Allen, Franklin.	Mrs. Etta M. MacKintosh, Franklin.	Mrs. Susie E. Adams, 65 Cottage St., Franklin.
Douglas, No. 145,	Alfred Foster, Manchaug.	Mrs. Effie Jones, East Douglas.	Miss Alma Quintal, East Douglas.
West Newbury, No. 146,	Edward B. Germain, East Haverhill.	Mrs. Ruth A. Ruddock, Groveland.	Mrs. Harriet M. Ware, West Newbury,
West Springfield, No. 147,	Homer B. Miller, West Springfield.	Mrs. Louise Viets, Mittineague.	Miss Lillian M. Capron, 59 Hanover St., West Springfield.
Swansea, No. 148,	Frank L. Gardner, South Swansea.	Frank C. Cole, Swansea.	Mrs. W. M. Chace, Swansea.
Harvard, No. 149,	Benjamin S. Keyes, Harvard.	Arthur T. West, Harvard.	Henry A. Knight, Harvard.
Concord, No. 150,	James S. Wilson, Concord.	Allan Brown, Concord.	Miss Clara Pettigrew, Concord Junction.
East Longmeadow, No. 152,	William Christopher, Ludlow, R. F. D.	Mrs. Herman W. King, East Longmeadow.	Miss Pearl E. Wood, East Longmeadow.
Wilbraham, No. 153,	L. L. Stone, Wilbraham.	Mrs. O. L. Millard, North Wilbraham.	Mrs. L. L. Stone, Wilbraham.
Haverhill, No. 154,	Milton A. Corliss, 1003 Broadway, Haverhill.	Mrs. Lela Dodge, Haverhill.	Mrs. Grace A. Merrill, Haverhill.
Methuen, No. 155,	William W. Mann, 9 Park St., Methuen.	Mrs. Blanche A. Buzzell, 61½ Union St., Methuen.	Miss Blanche A. Blodgett, 4 Barker St., Methuen.
West Bridgewater, No. 156,	Mrs. Anna S. Le Lacheur, West Bridgewater.	Henry J. Le Lacheur, West Bridgewater.	Mrs. Rhoda Wilbur, West Bridgewater.
Granby, No. 157,	Winfred F. Forward, Granby.	Charles N. Rust, Granby.	Miss Gladys M. Rust, Granby.
"Nemasket" of Middleborough, No. 158.	Sam. E. Stickney, Lakeville.	Mrs. Elizabeth Thomas, Middleborough.	Mrs. Annie D. Deane, Middleborough.
"Green River" of Williamstown, No. 159.	Dormant.	– –	– –
South Hadley, No. 160,	Herbert B. Lang, South Hadley.	Wm. W. Wilson, South Hadley.	Mrs. E. H. Lyman, South Hadley, R. F. D.
"Laurel" of West Newbury, No. 161,	Arthur L. Cunningham, Newburyport.	John A. Newhall, Newburyport.	Mrs. Belle E. Kennett, West Newbury.
Dartmouth, No. 162,	I. Arthur Crapo, South Westport.	Mrs. I. Arthur Crapo, South Westport.	Miss Madge Allen, Dartmouth.
Dudley, No. 163,	Ralph Easterbrook, Dudley.	Frank A. Putnam, Dudley.	Miss Ethel Bates, Webster.
Ware, No. 164,	F. W. Harwood, Ware.	Mrs. A. G. Buffington, Ware.	Miss M. R. Howard, Ware.
Hampden, No. 165,	Chas. I. Burleigh, Hampden.	Harold Ryder, Hampden.	Chas. N. Whitaker, Hampden.
Wellesley, No. 166,	G. Howard Frost, 200 Fuller St., West Newton.	Cyrus F. Jenness, 116 Moffatt Rd., Waban.	Charles F. Smith, Dover Rd., Wellesley.
Rowe, No. 167,	Mrs. A. L. Henry, Rowe.	Mrs. M. L. Proctor, Rowe.	Mrs. G. G. Stanford, Rowe.
Somerset, No. 168,	Mrs. Ida M. Stetson, Pottersville.	Mrs. Mary E. Rice, Pottersville.	Miss Lois A. Davis, Pottersville, R. F. D.

MASSACHUSETTS PATRONS OF HUSBANDRY — *Continued.*

NAME.	MASTER.	LECTURER.	SECRETARY.
Lunenburg, No. 169,	William A. Warren, Lunenburg.	Mrs. Edith L. Smith, Lunenburg.	Arthur W. Rockwood, Lunenburg.
New Braintree, No. 170,	Harry D. Pollard, North Brookfield.	Miss C. W. Titus, New Braintree.	Miss Clara K. Kittredge, North Brookfield.
Merrimac, No. 171,	Willard T. Kelly, Birch Meadow.	Mrs. Carrie M. Gilman, Main St., Merrimac.	Mrs. Cora L. Wadleigh, Church St., Merrimac.
Ashby, No. 172,	Edwin Walker, Ashby.	Mrs. Henrietta Willard, Fitchburg.	Mrs. Flora E. Ingerson, Ashby.
Hopkinton, No. 173,	William Peaslee, Woodville.	Mrs. Laura M. Phipps, Hopkinton.	Miss Minnie R. Kilburn, Hopkinton.
Brookfield, No. 174,	Victor Nelson, Brookfield.	Mrs. Charles Huntington, Brookfield.	Mrs. J. H. Bemis, Brookfield.
Athol, No. 175,	Mrs. S. Ella Stevens, Athol.	Mrs. Nellie Schmidt, Hampstead Pl., Athol.	Mrs. Fred R. Spaulding, Sanders St., Athol.
"Miller's River" of Orange, No. 176,	Joseph H. Cullen, Orange.	Miss Lulu Bronsdon, Orange.	Henry J. Coleman, 43 West Main St., Orange.
Sturbridge, No. 177,	Nelson Smith, Sturbridge.	Mrs. Beulah Corey, Sturbridge.	Mrs. George Adams, Sturbridge.
Ludlow, No. 179,	William M. Ashwell, Ludlow, R. F. D. 1.	Mrs. Dwight Taylor, Ludlow, R. F. D. 1.	Miss Edith L. Johnson, Ludlow, R. F. D. 1.
West Brookfield, No. 180,	Harold D. Phelps, West Brookfield.	Mrs. Grace Canterbury, West Brookfield.	Miss Marjorie Cutler, West Brookfield.
Westport, No. 181,	C. A. Brightman, Westport, R. F. D.	Miss E. S. Brightman, Central Village.	Arthur T. Potter, Westport, R. F. D.
Southbridge, No. 182,	C. R. Morse, Southbridge.	Mrs. George S. Rich, Southbridge.	Harry B. McKinstry, Southbridge.
Andover, No. 183,	Fred A. Swanton, Andover.	Ira B. Hill, Lupin's Rd., Andover.	Edw. W. Burtt, Andover, R. F. D.
Topsfield, No. 184,	Leroy Gleason, Topsfield.	Miss Elizabeth D. Peabody, Topsfield, R. F. D.	Miss A. G. Bradstreet, Topsfield, R. F. D.
Fitchburg, No. 186,	Joseph Donaldson, 7 Woodsome Ave., Fitchburg.	William W. Sterlin, 100 Snow St., Fitchburg.	Mrs. Nettie A. Woodman, 487 Water St., Fitchburg.
Littleton, No. 188,	Frank H. Hill, Littleton.	Mrs. Grace Cash, Concord Junction, R. F. D. 2.	Miss Augusta W. Smith, Littleton Common.
Warren, No. 189,	Archer N. Tuttle, Warren.	Miss Ruth E. Rice, Warren.	Miss J. L. Patrick, Warren.
Bellingham, No. 190,	Carroll F. White, Bellingham.	Miss Hannah E. Harrington, Bellingham.	Miss Olive May Clark, Bellingham.
Winchendon, No. 192,	Mrs. Anna V. Whitney, Winchendon.	Mrs. Ivonnetta G. White, Winchendon.	Charles W. Brooks, Winchendon.
Foxborough, No. 193,	William E. Perkins, Foxborough.	Matthias V. Bridges, Foxborough.	Miss Nellie F. Capen, Foxborough, Box 646.

Townsend, No. 194,	Frank A. Woods, Townsend.	Mrs. Esther E. Scales, Townsend.	Mrs. Flora I. Atwood, Townsend.
Royalston, No. 195,	Ernest L. Graves, Royalston.	Eri S. Stewart, Athol, R. F. D.	Myron E. Stockwell, Royalston.
Easton, No. 196,	Harrie J. Phipps, North Easton.	Mrs. Carrie Smith, North Easton.	Miss E. L. Howard, South Easton, R. F. D.
"Brookville" of Holbrook, No. 197,	James A. Stowers, Brookville.	Miss Edna G. Bowen, Brookville.	Miss Ruth M. Howard, Brookville.
Leominster, No. 198,	Andrew S. Thompson, Fitchburg, R. F. D. 1.	Miss Emma Sawyer, 27 Summer St., Leominster.	Mrs. Bertha Burchstead, 637 Main St., North Leominster.
Stoughton, No. 199,	Alton M. Cobb, Stoughton.	Miss Ella S. Henry, West Stoughton.	Mrs. J. Spaulding, West Stoughton.
Uxbridge, No. 200,	Francis E. Turner, Uxbridge.	Milton L. Goldthwaite, Uxbridge.	Helen J. Hollis, Uxbridge.
Bridgewater, No. 201,	George E. Copeland, 565 South St., Bridgewater.	Ella Berry, 81 Union St., Bridgewater.	Miss Grace Altier, Bridgewater.
Ashburnham, No. 202,	Ralph A. Latimer, Ashburnham.	Mrs. Caroline L. Gravelin, Ashburnham.	Mrs. Sadie M. Fosgate, Ashburnham.
Westminster, No. 203,	Robt. O. Hurd, Westminster, R. F. D. 2.	Mrs. G. C. Persons, Westminster, R. F. D. 2.	Miss L. E. Baker, Westminster, R. F. D. 1.
Rowley, No. 204,	Miss Edna E. Wallis, Rowley, R. F. D. 1.	Mrs. Alice A. Marshall, Main St., Rowley.	J. A. Marshall, Main St., Rowley.
"Webster" of Marshfield, No. 205,	L. C. Bartlett, Marshfield Center.	Mrs. Walter I. Seaverns, Marshfield.	Walter I. Seaverns, Marshfield.
Tewksbury, No. 207,	Harry C. Dawson, Tewksbury.	Mrs F. A. Haines, North Billerica, R. F. D. I.	Mrs. Olive M. Clark, 8 Western Ave., Lowell.
Westford, No. 208,	William J. Rafteo, Westford.	Mrs. Josie Prescott, Westford, R. F. D. 1.	Mrs. M. Aurilla Wright, Westford, R. F. D. 1.
Hanson, No. 209,	Dr. A. W. Gorham, North Hanson.	Mrs. Emily M. Baker, Hanson.	Mrs. Nan S. Harley, South Hanson.
Chicopee, No. 211,	Arthur A. Megargle, 177 Chicopee St., Chicopee.	Mrs. Arthur Megargle, 177 Chicopee St., Chicopee.	Mrs. Minnie A. Baldwin, 143 Chicopee St., Chicopee.
"Oak Hill" of Attleboro, No. 212,	Wm. E. S. Smith, Attleboro, R. F. D. 2.	Mrs. G. R. Field, Pleasant St., Attleboro.	Mrs. M. P. Smith, Locust St., Attleboro.
"Massapoag" of Sharon, No. 213,	Elmer E. Farnham, Sharon.	Mrs. Gertrude M. Covell, Sharon.	Mrs. Georgie B. Brown, Sharon.
Walpole, No. 214,	Wm. J. W. Wheeler, East Walpole.	Chas. W. Goodwin, Walpole.	Alice J. Crowley, East Walpole.
Mattapoisett, No. 215,	Chas. T. Dexter, Mattapoisett, R. F. D.	Miss Abby S. Westgate, Mattapoisett, R. F. D.	Mrs. Jane R. Stanton, Mattapoisett.
Dracut, No. 216,	Miss Hazel Weinbeck, 192 Wentworth Ave., Lowell.	Fred P. Vinal, Lowell, R. F. D. 2.	Mrs. F. M. Weinbeck, 192 Wentworth Ave., Lowell.
Norton, No. 218,	Lee Strople, Norton.	Mrs. Arthur Sweet, Norton.	Miss Nellie H. Lincoln, East Norton.
East Princeton, No. 219,	J. Haverlock Gates, East Princeton.	Perley Aldrich, East Princeton.	Mrs. Nellie D. Tyler, East Princeton.
Sunderland, No. 220,	Raymond S. Clark, Sunderland.	Miss Edith L. Warner, Sunderland.	Mrs. Arria B. Williams, Sunderland.
"Anawan" of Rehoboth, No. 221,	Leon E. Goff, 884 Broadway, East Providence.	Mrs. Elmie G. Fuller, Rehoboth.	Mrs. Annie R. Goff, Attleboro, R. F. D. 1.

MASSACHUSETTS PATRONS OF HUSBANDRY — *Continued.*

NAME.	MASTER.	LECTURER.	SECRETARY.
Tyngsborough, No. 222,	Mrs. Francena L. Sherburne, Tyngsborough.	Miss Jeannette J. Grant, Tyngsborough.	Norman R. Sherburne, Tyngsborough.
Billerica, No. 223,	Forrest F. Collier, Billerica.	Mrs. Lulu Hutchins, Billerica, R. F. D.	Miss L. Emeline Bates, Billerica.
Sheffield, No. 224,	Albert M. Chapin, Sheffield.	Grace L. Goodwin, Sheffield.	R. Raymond Little, Sheffield.
Williamsburg, No. 225,	Wilbur M. Purrington, Haydenville.	Mrs. Arthur J. Polmatier, Williamsburg.	Raymond A. Warner, Williamsburg.
West Medway, No. 226,	Fortes D. Wheeler, Caryville.	Mrs. Rose M. Wood, West Medway.	Mrs. Katherine L. Siggins, Medway, R. F. D.
Heath, No. 227,	Oscar R. Thompson, Griswoldville.	Ernest W. Payne, Heath.	Homer S. Tanner, Griswoldville.
Salisbury, No. 228,	Winfred Pike, Salisbury.	Mrs. Mary H. MacConnell, Salisbury.	Miss Frances Bragg, Salisbury.
Cochituate, No. 229,	Henry B. Poole, Jr., Cochituate.	Miss Nellie E. Cross, Cochituate.	Mrs. Florence M. Holm, Cochituate.
Taunton, No. 230,	George Lincoln, 127 Walker St., Taunton.	Mrs. Susan Harvey, 50 Fields St., Taunton.	Miss Bernice Gushee, Somerset Ave., Taunton.
"Ponkapoag" of Canton, No. 231,	Oscar D. Capen, Washington St., Canton.	Albert A. Boutelle, Canton, R. F. D.	Joseph F. Cummings, Hyde Park.
Plainfield, No. 232,	Ralph W. Rice, Plainfield.	Mrs. J. M. Dandeneau, Plainfield.	Mrs. Emma Gloyd, Plainfield.
Lexington, No. 233,	Nathaniel Stearns, Trapelo Rd., Waltham.	Miss Beatrice Stoney, 123 Massachusetts Ave., East Lexington.	Mrs. William H. Hooper, 71 Elm St., North Woburn.
Newbury, No. 234,	Hallet W. Noyes, Newbury.	Miss Ethel L. Chase, Newburyport.	Joseph D. Rolfe, Newbury.
Oakham, No. 235,	John Robinson, Oakham.	Mrs. Effie Swindell, Oakham.	Richard Malcolm, Oakham.
"Quascacunquen" of Byfield, No. 236.	Miss Harriet M. Pillsbury, Byfield.	Mrs. Fred Cheney, Byfield.	Miss Jessie N. Towne, Rowley, R. F. D.
Groveland, No. 237,	Miss M. M. Brown, 11 Broad St., Groveland.	Mrs. Mary J. Hemeon, 291 Main St., Groveland.	Miss M. Lottie Tuttle, 149 Main St., Groveland.
Bradford, No. 238,	Justin Thornton, Ward Hill.	John Currier, 39½ Eighth Ave., Haverhill.	Mrs. Verna Tuck, 27 Laurel Ave., Bradford.
North Reading, No. 239,	Harvey G. Turner, North Reading.	Ruth M. Weymouth, North Reading.	Stanley W. Nichols, North Reading.
Palmer, No. 241,	F. D. Rogers, Monson.	Mrs. J. O. Hamilton, Palmer.	Mrs. E. J. Freeman, Palmer.
Rutland, No. 242,	William Spindler, Rutland.	Mark A. Putnam, Rutland.	Mrs. Frances P. Hanff, Rutland.
Enfield, No. 243,	Herbert A. Coolbeth, Enfield.	Mrs. John H. Hann, Enfield.	Miss Dora C. Foley, Enfield.
Chelmsford, No. 244,	Arthur E. Dutton, Chelmsford.	Fred L. Fletcher, Westford.	Harlan E. Knowlton, North Chelmsford.
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